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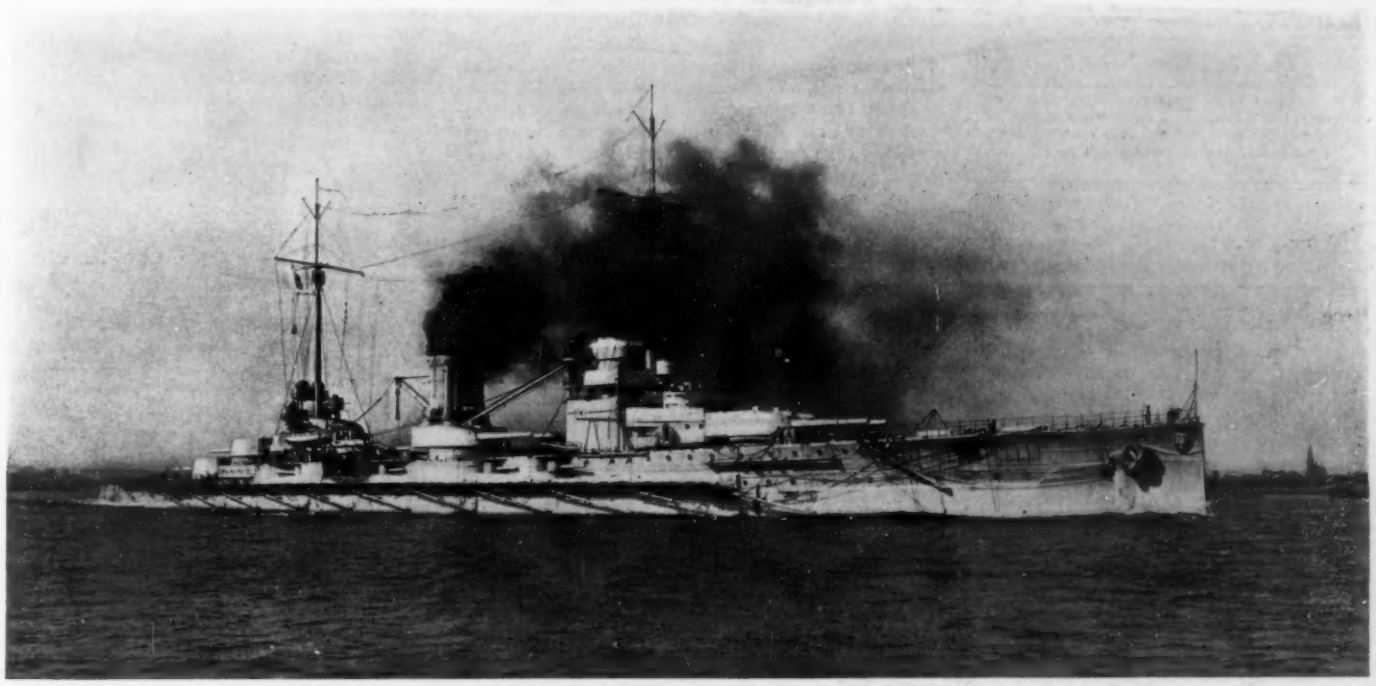
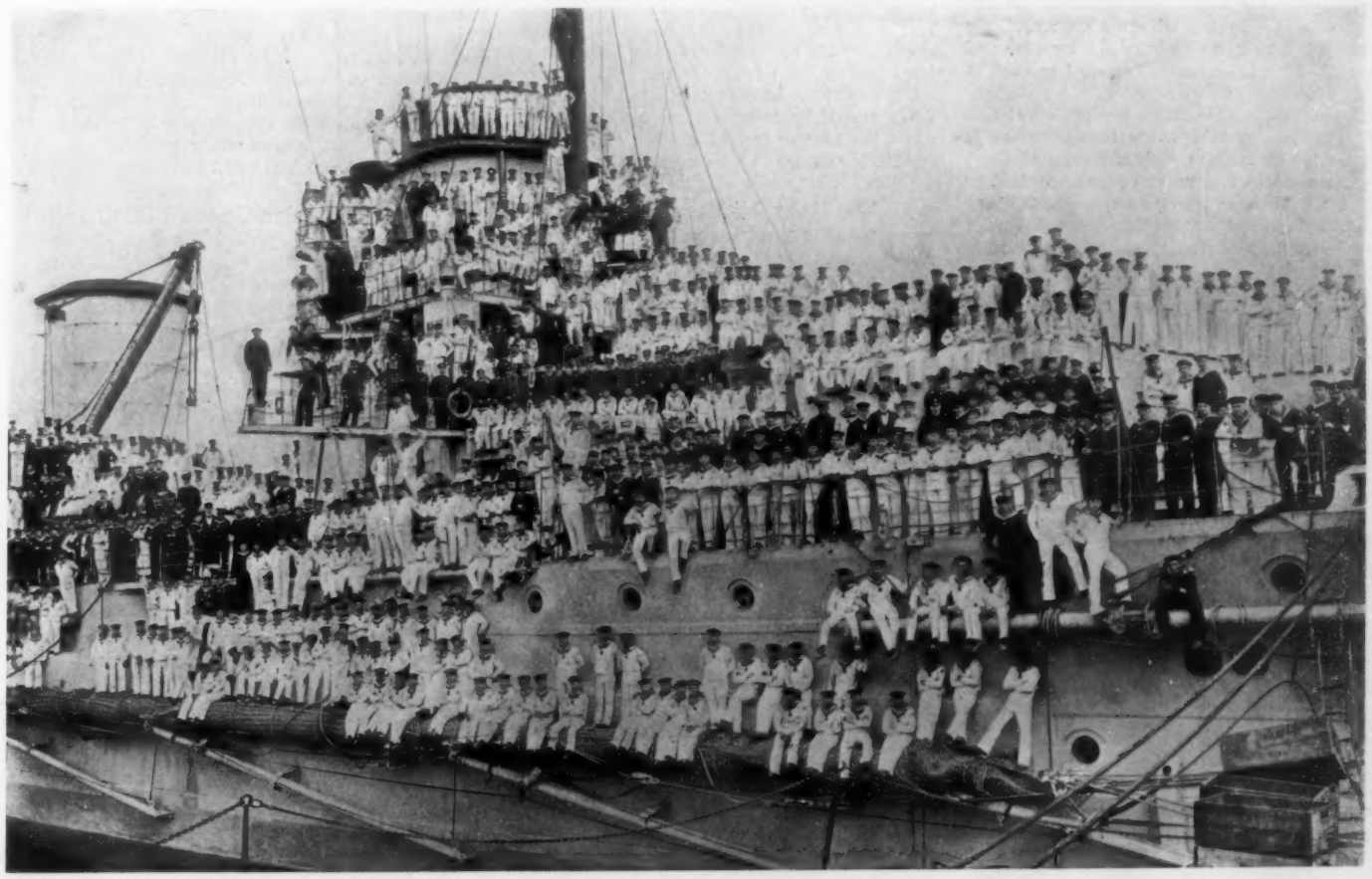


Length, 590 feet; beam, 88 feet. Displacement, 23,500 tons. Maximum coal supply, 2500 tons. Speed, 29 knots. Armament: ten 11-inch, 50-caliber guns; twelve 6-inch rapid-fire-guns. Torpedo tubes, 4 submerged.

THE GERMAN TWENTY-NINE KNOT BATTLE-CRUISER "MOLTKE"



This view is taken off the starboard bow. The lowest line of men is massed on the chain torpedo-netting, which is rolled up in the stowed position.

THE CREW OF THE GERMAN BATTLE-CRUISER "MOLTKE"—[See page 560.]

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The Editor is always glad to receive for examination illustrated articles on subjects of timely interest. If the photographs are *sharp*, the articles *short*, and the facts *authentic*, the contributions will receive special attention. Accepted articles will be paid for at regular space rates.

The purpose of this journal is to record accurately, simply, and interestingly, the world's progress in scientific knowledge and industrial achievement.

The Recent Army Aeronautical Accident

IF the investigation conducted by officers of the Signal Corps is correct in its findings, the tragic death of Lieut. Leighton W. Hazelhurst, Jr., and Arthur L. Welsh, through the sudden collapse of their aeroplane, was due to the excessive strain thrown on the machine at the bottom of a sharp dive, which was made preparatory to climbing for an altitude test.

We have more than once in these columns drawn attention to the very serious risk which is taken by an aviator, at the end of a long dip to earth, if he suddenly makes a sharp change in the direction of flight from the oblique to the horizontal. The high velocity acquired by the machine on its oblique path earthward is equivalent to a high falling velocity in the vertical direction. When a sudden change of direction to the horizontal is made, the dynamic stresses approximate those which would be set up, if the machine were suddenly arrested while falling vertically at a velocity equal to the vertical component of its speed. The effect is to produce a heavy bending stress on the sustaining surfaces. In several cases on record the planes have failed near the body of the machine and folded up. This is what appears to have happened in the recent accident.

Now it is doubtful if more than a few of the aviators of to-day appreciate what a heavy bending stress is brought upon the planes by a sudden change of direction when the machine is running at high speed. The conditions are the same, whether an exceedingly sharp turn be taken in a horizontal plane, in rounding a turning stake, or in a vertical plane when making a dive.

This subject was treated at considerable length by Dr. A. F. Zahm in an article on "Stress in Aeroplanes in Curvilinear and Fancy Flight" which was published in the SCIENTIFIC AMERICAN of August 26th, 1911. Dr. Zahm's conclusions show that, at a speed of 100 miles an hour, a turn with a radius of only 100 feet would develop a centripetal force 4.55 times the weight of the machine and its pilot; the pilot moreover would feel heavier on his seat than he would if he were sitting still, with a man of his own weight on either shoulder.

Again, if a swoop earthward is made in which the speed accelerates to 90 miles an hour, and if the turn near the ground is made with a curvature whose radius is two hundred feet, the total upward thrust on the sustaining surfaces would be 2.84 times the total weight of the machine—in other words, the stress in the planes would be nearly three times as great as when the machine was in level flight.

Why Not Patents for New Plants and Animals?

IT took the law-makers of the world many centuries to provide more or less adequate protection for the inventor—the man who gives to the world a useful process, a useful compound, or a useful machine of which it never knew before. Not yet have they realized the necessity of encouraging and rewarding the man who adds to the world's wealth by means no less practical than those of the inventor of steam engines or the designer of new chemical compounds—the man, in a word, who improves the living things of nature instead of fashioning new things out of inanimate matter. We have devised a patent system for the protection of him who invents a novel way of generating power, a novel way of communicating between New York and London, a novel way of weaving; but we have not yet protected the experimenter who gives us a variety of wheat richer in protein than the old, or a variety of cattle immune to the Texas fever tick. By a curious anomaly a man may patent a new instrument for discovering a useful microbe; but if he devises a means for increasing that microbe's usefulness to the world, he cannot patent his discovery. Why not?

Steamship Routes in Northern Waters

THE dream of establishing trade routes in far northern waters has been cherished by navigators for centuries, and has been the incentive of many voyages that are land marks in the history of exploration.

The partial realization of this dream now seems to be at hand. The long-talked-of Hudson Bay Railway, to connect with a steamship line *via* Hudson Bay, Hudson Strait, and the Atlantic to the Old World, appears to be at last assured. If the hopes of its promoters are realized, it will afford for a brief two months in the year an outlet for the vast resources of western Canada; above all, improved facilities for moving the Canadian wheat crop to European markets.

An analogous project on the other side of the Atlantic contemplates the establishment of regular steamship service between England and Siberia by way of the Kara Sea and the estuaries and the Yenisei and the Obi rivers. This plan, proposed by an Englishman, Capt. Webster, has been approved by a Russian government commission. Steamers will run from English ports to a harbor on the southwest coast of Novaya Zemlia. There the cargoes will be transferred to smaller vessels specially built for ice navigation, and thus carried to the Siberian rivers. As in the case of the Canadian project, it is expected that navigation will be limited to two months in the year, which will afford time for three round-trip voyages. The cargoes will include grain, timber, graphite, mica and other minerals.

Finally, the Russian government is making every effort to establish a regular sea route to northeastern Siberia by way of Bering Strait. During the summer of 1911 Rear Admiral Trajan, acting under instructions from the Imperial Ministry of Industry and Commerce, took the steamer "Kolyma" from Vladivostok to Nijni Kolymsk, at the mouth of the Kolyma River, where a quantity of freight was landed, after which the vessel returned to Vladivostok, the whole journey occupying two months. A little later in the season this feat was duplicated by an American sailing vessel, equipped with an auxiliary motor. In this case the journey was made from Alaska.

The experience of the "Kolyma" showed that a light-draft vessel, by keeping close inshore, was able to avoid the heavier ice fields. The "Kolyma" was not especially adapted for ice crushing.

The Dairy Problem in the Tropics

PROBABLY no one problem is of greater economic importance in the tropics than the successful introduction of dairies. Condensed milk, evaporated cream, and tinned butter almost universally supply the place of the cow in hot countries; for this animal is generally supposed to be unable to thrive on the forage plants of the tropics and to withstand tropical diseases. The unique exception to this state of affairs appears to be found in Hongkong, where a dairy company, founded twenty-five years ago mainly as a philanthropic enterprise and operated for fifteen years without profit, is now on a very remunerative footing, paying dividends of about 18 per cent on the investment. Its herd was completely wiped out three times before the problem of its successful maintenance was solved.

The food of the herd, decided upon after many disastrous experiments, is partly Guinea grass—grown in the island—and partly fodder of various kinds imported from temperate latitudes, viz., Australia, North China, and Europe. Diseases are prevented by stall feeding and a rigid system of quarantine. The herd comprises over 450 head of Ayrshires, Holsteins, and Jerseys of the best milking strain.

The urgent demand of American residents in the Philippines for fresh dairy products has led to many attempts—so far unsuccessful—to establish imported herds of milch cattle. Under government encouragement these attempts have now been renewed on a large scale near Manila. Cattle are being imported from Australia, and it is understood that a large tract of land about twelve miles from the city has been secured for the undertaking. A similar enterprise is under way at Singapore, where the colonial authorities have sought the co-operation of the Hongkong company mentioned above. The stress laid upon protection from disease is shown by the extraordinary measures adopted in Hongkong; visitors from other parts of the island and from China are not allowed access to the herd except under such conditions as to make the carrying of disease germs impossible; the employees must change their clothes before entering or leaving the premises; and the sheds in which the cattle are confined are carefully screened against disease-carrying insects.

How the Wind and the Ocean Surf Shake the Globe

TO the average man any movement of the "solid" ground is—unless he happens to live in a particularly shaky country, such as Japan—a striking exception to the normal order of nature. To the seismologist, on the contrary, absolute tranquillity of the earth is the exception, and the quakes—large or small—are the rule. The little quakes are quite as interesting from the scientific point of view as the big ones that lay populous cities in ruins. As Prof. Arthur Schuster said in a recent address to the International Association of Seismology:

"To the man in the street the question whether a thing is large or small is all-important; to the scientific man it matters not at all; and a great part of our deliberations deal, not with catastrophes, but with microscopic movements of the soil, movements so small that the vibrations due to the traffic in a city compare with them as the waves of the ocean with the ripples on a pool."

The study of these minute movements—entirely imperceptible to the senses, but plainly registered by the marvelously sensitive pens of the seismograph—is just now occupying the special attention of seismologists. There is an international commission for the study of these "microseisms," as they are called; and they have been the subject of many elaborate memoirs in the enormous recent literature of earthquakes. Already some surprising discoveries have been made about them.

One type of microseism has a period of thirty seconds. This has been traced to friction of the wind upon the earth's surface. In other words, the wind creates waves—vibrations—over an extended land surface, just as it does over the ocean.

Another type has a period of from five to ten seconds. This is found to have no relation to the wind or to other meteorological conditions. It is now most plausibly attributed to the impact of waves on the seashore. Great storms on the Atlantic thus set up trains of little earth-waves, which are registered at Hamburg, Strasburg, Vienna—their amplitude decreasing with the distance inland. The most conclusive studies in this direction have been made at Apia, Samoa, where a fine geophysical observatory is maintained under German auspices. Dr. Linke, the former director, showed that here, at least, microseismic movements were caused directly by the surf.

There are several other types of microseisms, the causes of which are still undetermined.

A Solar Corona Due to Pollen

PROF. E. DAGUIN describes in *L'Astronomie* a solar corona observed by him while traveling, by rail, across a pine forest between Dax and Bayonne, France, May 7th, 1911. In its mode of origin it appears to have been unique among optical phenomena of this character heretofore reported.

Solar and lunar coronas—i. e., small colored rings around the sun and moon—are diffraction phenomena, and usually occur when the light from these bodies shines through thin clouds. They are commonest when the clouds consist of water-drops; but multiple coronas, beautifully colored, are often seen in the higher clouds, consisting of ice-particles. Solar coronas, though common, are not often noticed, on account of the blinding splendor of the sun; in order to see them well the eyes must be protected by dark glasses, or the sky must be viewed in a black mirror.

An abundance of dust in the air may give rise to the same phenomena. The largest type of coronas ever observed was that frequently seen during the years following the great Krakatoa eruption, and known as "Bishop's ring"; it was produced by fine volcanic dust suspended in the upper air.

Prof. Daguin's observation was made about 7 P. M.; the sun was very red and was surrounded by rosy circles, reminding the observer of the appearance of a luminous source examined through a plate of glass sprinkled with lycopodium powder.

The corona was evidently produced by the pollen of the pine tree, with which the air of the forest was abundantly charged. The next day, about the same hour, a less conspicuous corona was observed at Beyris. Shortly afterward the air was washed by a shower of rain, and no coronas were observed on subsequent days.

Engineering

Concrete Work at Panama.—Excellent progress continues to be made with the concrete work on the Panama canal. The spillway of Gatun dam is 88 per cent completed and for the system of three twin locks at Gatun over 93 per cent of the concrete is in place. At Pedro Miguel over 94 per cent is done, and over 66 per cent of the concrete has been laid at Miraflores.

Test of Gatun Lock Gates.—The first of the upper guard gates to be completed in the east chamber of Gatun lock was recently swung to a position halfway open; then shut, opened wide, closed, and finally swung halfway open. The gate, which weighs 448 tons, is 64 feet high, 65 feet long, and 7 feet thick. In spite of its great weight it was shut and opened noiselessly without any jar or vibration, and at all times it was under perfect control.

Croton Reservoirs are Full.—In view of the water famine which was threatened toward the close of last year, it is gratifying to know that all of the reservoirs in the Croton River valley were filled by the beginning of May this year, the only exception being Lake Mahopac, in which the water level was within four feet of the spillway. At that time the total amount of water stored in the combined reservoirs was 104,409,000,000 gallons, the total available capacity being 104,443,000,000 gallons.

Another Submarine is Lost.—During the recent war maneuvers off Cherbourg, the French submarine "Vendemiaire" was run down by the battleship "St. Louis" and sunk in one hundred and fifty feet of water. The submarines were engaged in attack and the "Vendemiaire," apparently, was rising to the surface for observation. The periscope of the submarine suddenly emerged dead ahead of the "St. Louis," whose ram immediately overrode the little craft, probably cutting open her plating. This is the fourth submarine lost by the French navy.

Development of the Railway System of the World.—The length of the railway lines for the end of 1909 (the latest figures available) are as follows: Europe, 329,691 kilometers; America, 513,824 kilometers; Asia, 99,436 kilometers; Africa, 33,481 kilometers; Australia, 30,316 kilometers, or a total of 1,006,748. The average cost of construction per kilometer of line is $76,718 for Europe, and $41,785 in other parts of the world. On this basis the European railways at the end of 1909 would have cost $25,293,000,000, while the railways in other parts of the globe would have cost $28,829,100,000.

Searchlights for Passenger Steamers.—Our contemporary *Nature* states that the absence of searchlights from merchant ships is due to the action of the British Admiralty, which was opposed to their use on any but warships. As a matter of fact, searchlights are unpopular with the officers of the ships which ply to and fro across the Atlantic. They claim that the beam of light is blinding even to the lookout on the ship which uses it, and that in clear weather the lights of another ship can be seen with greater certainty by the lookout than they would be if his own ship were using a searchlight.

Model of the Panama Canal Lock.—An interesting exhibit at the recent International Navigation Congress in Philadelphia was a model showing the whole of the Gatun locks with the gates, emergency dam, fender chains, towing locomotive tracks, and all accessories. Another model on the scale of one half inch to one foot represented a section of the lock wall with the miter gates, opening and closing machinery, valves and fender chain gear. The model lock walls were built of cement mortar, and certain sections were removable to permit examination of the valves and operating machinery.

Railroad Accident Statistics.—One of our railroad contemporaries draws attention to the statistics of the State of Indiana, giving a comparison of accident records of various kinds for the years 1911 and 1902, which show the increase in ten years. According to these figures, deaths from natural causes, in which county coroners were called in for examination, increased 50.9 per cent; homicides increased 32 per cent; and deaths from all accidents other than on steam, interurban and street railways increased 51.9 per cent. The increase of steam railway accidents in the same interval was 46.2 per cent. Our contemporary points out that the percentages of increase of deaths due to accidents on interurban roads and street cars, from natural causes, and from other accidents, were all greater than for the railways.

Excellent Target Practice.—According to the *Fleet Review* some exceedingly fine shooting was done by the United States ship "Utah" during the spring maneuvers, when, with her ten 12-inch guns, she made the maximum possible number of hits. The first salvo landed "all over the target;" the second carried away the upper part of the target, and the third destroyed it entirely. One pole was left standing, and with this as a target the next five salvos were bunched on the top of the pole—all of this being done at a range of ten thousand yards. Our contemporary is certainly justified in his conclusions that an enemy's ship, had she been the target of that fire, would have keeled over and gone down under the impact of salvos so accurately placed.

Science

Whale Hunt Results in 1911.—As a result of last year's whale hunts, there have been obtained about 600,000 barrels of fish oil, as against 309,000 barrels in 1910. Of these, Norwegian fisheries lay claim to 340,000 barrels.

The World's Spindles.—The total number of cotton spindles in the world at the end of 1911 was estimated at 137,278,752, compared with 133,384,794 for the end of 1910. The number of spindles for England at the end of 1911 was 54,522,554; for the United States, 28,872,000; for Germany, 10,480,090; for Russia, 8,671,664; for France, 7,300,000; for India, 6,250,000; for Austria, 4,563,745; for Italy, 4,582,065, and for Japan, 2,131,494.

Measuring and Determining Color Qualities.—Perley Gilman Nutting of Washington, D. C., has patented, No. 1,026,878, a method of determining the hue, purity and luminosity of a beam of light in which he determines the wave length of the dominant hue or its complementary as the case may be; also the proportion that the white light in the unknown bears to the pure light of the dominant hue therein and the luminosity of said beam.

Gold Medal for Leadless Paint.—In connection with the campaign against lead poisoning on the European continent, the Committee of the Industrial Association for Lower Austria has offered a gold medal for the best method of preparing leadless printing and lithographic colors, to represent a perfect substitute for colors containing lead—as those in use at present—such as lead white, chrome yellow, etc. The substitute must give the same result as regards spreading power and appearance, without endangering the printer's health.

The Popularity of the Medical Department of the Paris University.—The University of Paris, says the *Athenæum*, seems to be increasing in popularity on its medical side, the number of foreign students who matriculated during the past year in the Faculty of Medicine being 805 as against 736 in the year preceeding. Of these, no fewer than 540 came from Russia, 64 from Turkey, 59 from Latin America and 50 from Roumania, while England was represented by a solitary student. Russia was also easily first in the number of women students, sending 317 as against 4 from Turkey and 4 from Roumania.

Detection of Wood Alcohol.—W. Sailer describes the following test for the detection of wood alcohol in grain alcohol (ethyl alcohol). Five cubic centimeters of the latter are treated with 0.1 gramme chromic acid and 10 drops of concentrated sulphuric acid. The liquid will take on a green color; as soon as the color change has taken place, 6 drops of the solution are mixed with 20 drops of concentrated sulphuric acid and a small quantity of morphine. If a large percentage of wood alcohol is present (50 per cent or more) a dark violet coloration will be produced; a smaller quantity produces a red color, while traces of wood alcohol will cause a yellowish-brown coloration.

An Improved Cup of Coffee.—A recent German patent has for its object the preparation of a coffee beverage which is perfectly clear and entirely free from any foreign tinge in its taste. The coffee is first boiled up in the usual way with water. The sediment is then allowed to settle on a fine meshed sieve for about six minutes, whereupon the infusion is filtered through this same sediment. The fine particles always present in the infusion of coffee are deposited in form of a slimy film on the surface of the sediment. Claim is also made of a larger yield of the extract by this method than is usually obtained by any other methods of preparing this beverage. This method (or at least a very similar one) is used in Turkey and Roumania for preparing Mocha coffee.

The Polar Malady.—In an address lately given before the Zoological Society of France, Dr. Jacques Liouville, the physician and naturalist who accompanied the "Pourquoi-Pas" on her antarctic expedition, stated the chief physical troubles with which the crew had to contend were three in number, all in his opinion springing from the lack of fresh food. He therefore terms this polar malady "the disease of conserved food." The malady comprised symptoms of scurvy, polar anæmia, and severe frost-bites or chilblains, which frequently bled constantly. The underlying cause of all the affections is an alteration in the chemical composition of the blood—or "dyscrasia." The heart functioned badly, and the patients suffered from terrible shortness of breath, frequent drowsiness, and œdema of the lower extremities. They were easily exhausted and unable to march, while the slightest movement brought on intense palpitation. However all these morbid symptoms disappeared within 10 days when fresh meat was obtainable, and did not reappear again after the fresh wild celery obtained at Tierra del Fuego had been enjoyed for some time. Dr. Liouville took a just pride in the fact that this was the first polar expedition which ever restored all its members to their homes in a state of perfect health. He had three surgical cases to handle. Recovery was highly satisfactory, which he ascribes partly to the entire absence of pathogenic bacteria, and partly to the fact that there was not a trace of alcoholism in the patients.

Aeronautics

A "Sun Compass."—In the *Deutsche Luftfahrer Zeitschrift*, Dr. H. H. Kritzinger suggests that the sun-dial principle may be used to construct an instrument which will serve to guide the aviator as well as the balloonist. Because of the vibration of an aeroplane it is harder to use a "sun compass" in a flying machine than in a balloon.

The Physician's Aeroplane.—On June 9th, Dr. P. L. Alden of Hammondsport paid a professional visit in a hydro-aeroplane. The doctor received a hurry call to go to Urbana where an eleven-year-old boy had fallen from the third story balcony of a building and had sustained serious injuries. The doctor called up aviator Robinson, who promptly agreed to fly across the lake with him. Ten minutes later the machine glided down to the water and ran up on the beach in front of the house in which the boy was lying.

Why Airmen are Killed.—Major Roche of the French army is responsible for the statement that 25 per cent of the accidents sustained by aviators are due to lack of natural aptitude, 25 per cent to poor construction in the aeroplanes, 13 per cent to insufficient training of the pilots, 13 per cent to a total misconception of the limitations of the aeroplane, from 10 to 12 per cent to atmospheric conditions, over which the aviator has no control, and 6 per cent to sheer recklessness of aviators who go up without testing their machines or land on unfamiliar ground.

The Pekin to Paris Race.—If there are five entries before June 16th, a race will be held from Pekin to Paris under the auspices of the Aero Club of France. The start will take place from Pekin on September 1st, and the competitors will be required to pass the official controls on the following dates: Ourga, September 14th; Irkoutsk, September 21st; Omsk, September 28th; Moscow, October 11th; Vienna, October 19th; Genoa, October 25th; Paris, November 1st. The prizes will be 100,000 francs, 25,000 francs and three of 10,000 francs each. Should no competitor complete the full distance, the man who travels the farthest will receive a prize of 50,000 francs provided that Omsk has been passed.

Two Fatalities in Germany.—On June 2nd Albert Buchstaedter, one of the best known German aviators, and his passenger, Lieut. Stille, of the German army, were dashed to death just after starting in the Northwestern Aviation Circuit Race of 425 miles. Buchstaedter was driving a monoplane, when, making a rapid turn before straightening out for his long journey, he apparently banked his machine too far and slid down to his death. The machine had to be sawed apart before the bodies of the two men could be extricated. Fifteen professional aviators, each carrying a number of the Army Aviation Corps, were entered for the event. The circuit, to include the cities of Muenster, Hanover, Brunswick, Lübeck and Hamburg, was at once abandoned when it became known that the accident had resulted fatally.

A New Aerial Gun.—Capt. Charles de F. Chanler, chief of the Aeronautical Division of the United States Army Signal Corps, made some interesting experiments on June 8th last at College Park, Maryland, with a new aeroplane machine gun. Flying at a speed of about fifty miles an hour, the aviator fired half a hundred shots at a space three by twelve feet. Capt. Chanler handled the gun, while Lieut. Thomas de W. Milling navigated the machine. The gun is the invention of Col. J. N. Lewis of the Coast Artillery. It weighs 25½ pounds. It was lashed to the machine in such a manner that the breech rested almost in the lap of the gunner. Fifty shots were fired. Of the first ten, five hit almost in the center of the target, while the remainder were within the target field. Fifteen shots followed, and five of these struck the center of the target. Five shots were fired at a pond some distance away and hit the mark. The remaining twenty bullets found the target in various positions. The gun was fired at an angle of about forty-five degrees.

Wilbur Wright on Ader.—In a recent number of the Bulletin of the Aero Club of America, the late Mr. Wilbur Wright had some interesting comments on Ader's work, which he accompanied by official documents of the French Government, showing that the Ader machine never left the ground. "It started with the wind on its back, and rolled along on the ground at a speed not greater than twelve or fourteen miles an hour. The wind on its back and the pull of the screws tended to force the upper part of the apparatus forward, while the friction of the wheels on the ground retarded the machine below, so that there was a tendency of the apparatus to turn over on its nose and lift the rear wheels from the ground." During the trial of the Wright French patent suit, the court visited the museum where the Ader machine is preserved, and found that it contained no provision for varying the angles of the wings. Mr. Ader was present and stated that the machine of 1890 possessed means for distorting the wings, but that the use of two propellers capable of being run at different speeds had made this distortion unnecessary in the 1897 machine. This statement proved that the abandoned device related to steering and not to lateral balancing.

The German Battle-cruiser "Moltke"

A Fine Example of a New Type of Fighting Ship

THE recent visit of the German cruisers to New York afforded a greatly appreciated opportunity to take a look at the latest and certainly the most interesting of the German warships. The squadron included three vessels: The "Moltke," the "Stettin," and the "Bremen." Of these, the "Moltke" was the most important and attracted naturally the greatest amount of attention. The "Stettin," one of a class of three ships, was built in 1907. She is a protected scout-cruiser of 3,450 tons displacement, and she has made an average speed of twenty-four knots in a recent trial on a sea course of 170 miles—a most creditable performance. She is armed with ten 4.1-inch 40-caliber guns and two submerged torpedo tubes, and she is protected by a two-inch armored deck. She is driven by Parsons turbines, and her maximum coal capacity is 850 tons.

The "Bremen" is one of a class of five ships. Her displacement is 4,250 tons, and on her last trial, over a sea course of 170 miles, she averaged 23.2 knots. Her armament and armor protection are similar to those of the "Stettin," although she ante-dated that ship by four years.

Germany, of late years, has been giving a considerable amount of attention to the development of a fleet of fast scout vessels, and the "Stettin" and "Bremen" are excellent representatives of this type of vessel.

Public interest, however, centered in the "Moltke," which showed to great advantage as she swung up and down stream in the Hudson River. One's first impression of the ship is decidedly favorable; for she looks the powerful fighting craft. Her comparatively low freeboard, for a ship of her size and length, is something of a surprise. The spar deck runs flush from the stemhead throughout some two-thirds of the length of the ship. Then there is a drop of the height of one deck to the quarterdeck. The freeboard aft cannot be much over twelve or thirteen feet at full load. From the break of the quarterdeck forward the ship has a long sweeping sheer, which serves to bring her bow well up above the water, the freeboard on the forward deck being not less, we should judge, than twenty-six feet. This, associated with a widely flaring bow, should serve to render the ship fairly dry when driving into a head sea. The appearance of low freeboard is accentuated by the two smokestacks, which are low but of unusually large diameter.

Rear-Admiral von Rebeur-Paschwitz boarding the "Moltke."

The daily inspection aboard the "Moltke."

We do not recall any ship in which the main armament shows to such good advantage as on the "Moltke." On the forecastle deck, forward of the conning tower, is a two-gun turret. Amidships there are two two-gun turrets, placed diagonally with a view to securing a fire of all four guns on either broadside; and aft, are two turrets, the Germans having adopted the system of superposed firing, which originated in our Construction Department and found its first expression in the "Michigan" and "South Carolina."

The armament consists of ten 11-inch guns and twelve 6-inch. The 11-inch gun is of fifty calibers length, and, according to the ballistic tables of the Krupp guns, it has a muzzle energy of 42,445 foot-tons, which compares well with the energy of the 40-caliber 12-inch piece with which some of our earlier battleships are armed. It is much less however than the muzzle energy of our 12-inch, 45-caliber gun, and of course is much below that of the 50-caliber, 12-inch, with which our latest battleships are equipped, the muzzle energy in these guns reaching 52,480 foot-tons. However, every warship is a compromise; and when we take into consideration the enormous speed developed by the "Moltke," it will be admitted that she carries an exceedingly heavy armament.

Of the armor protection it is more difficult to speak with certainty. She is protected by a belt which extends practically from stem to stern. It is probably from 7½ to 8½ inches in maximum thickness at the water line, and tapers to its bottom edge which is four or five feet below the normal water line. Above water, the protection diminishes to about 4½ inches, and of course, there is a diminution in thickness toward the bow and stern of the ship. It is scarcely possible that the "Moltke" carries less than nine or ten inches of armor on her barbettes and turrets; but this is a pure guess. As a matter of fact, the Germans will tell you everything about their ships, except the facts relating to armor. The approximation which we have made is probably over rather than under the mark; for the "Moltke" is so heavily gunned and has such a powerful engine and boiler-room plant and such a generous supply of coal, that we cannot believe the naval architect was able to give very much of his weight to armor protection—certainly not nearly as much as he would have liked to have done.

The principal dimensions of the "Moltke" are as follows: Length on water line, 590 feet; beam, 88 feet; maximum draft, 28 feet. Her normal displacement is about 22,000 tons, and at full load she displaces about 23,500 tons. She carries a complement of about 1,000 officers and men.

Perhaps the most notable thing about the "Moltke" is her high speed. On her trials for acceptance, she ran for several hours at the average speed of 29 knots. During this trial her Parsons turbines developed, continuously—so we are informed by the chief engineer of the vessel—between 88,000 and 90,000 horse-power—a truly astonishing result.

To American eyes, while the "Moltke" is an exceedingly handsome and shapely craft of remarkable speed and good gun-power, it is difficult to understand just what sphere she will fill in future naval warfare. Her armor protection is too light to allow her to lie in line of battle, and her guns seem over-heavy for the work of scouting. Probably she will be used in breaking through the outer fringe of armored scouts of the enemy and getting near enough to ascertain his real strength. In our navy we have preferred to put our displacement almost entirely into heavily-protected battleships, which will be able to lie in line against the heaviest ships afloat and take the hardest kind of hammering. However, the battle-cruiser finds great favor in the eyes of those great rival nations—the Germans and the English—both of whose navies contain many of this class in commission and many more under construction.

A study of the underwater construction of the "Moltke" shows what great attention the Germans are paying to the question of defense against the mine and the torpedo. The double bottom is of unusual depth, and where the inner skin rounds up into the sides, the space between the outer and inner skin is greatly increased, being not less than four or five feet at the water line. Several feet inboard from this is a torpedo defense bulkhead, which runs the entire length of the machinery and boiler spaces, and inside of this is the longitudinal bulkhead which forms the inner wall of the coal bunkers. The double-hull construction extends to the waterline, and here it is covered in by a heavy deck of steel—the protective deck. This deck is thoroughly watertight. Another excellent feature in this ship which should greatly assist her maneuvering powers, rendering her very quick in answering the helm, is the fact that the deadwood, both forward and aft, is cut away to an extent which we have never seen in any other war vessel. The contour of the ship at the bow shows that immediately after dipping below the water, the hull slopes sharply aft for a distance of seventy or eighty feet, with a step for the forward torpedo tube. There is a similar cutting away of the deadwood aft, the profile showing two deep steps with a rudder at each step. Both rudders are on the central axis of the ship, the forward rudder being at a lower level than the after rudder. The large rudder area in conjunction with the cutting away of deadwood forward and aft should make this ship excellent in maneuvering.

A Scientific Test of the Electric Truck

An Impartial Study of the Comparative Cost of Horse-drawn and Power Vehicles

By John Ritchie, Jr.

BUSINESS men, especially those who are contemplating the use of motor trucks, will do well to keep informed of the experiments that are under way at the Massachusetts Institute of Technology, for here there is partly completed a scientific investigation of greatest commercial importance, an investigation which is a critical consideration of the transportation of merchandise in large cities with especial reference to the comparative performance and the cost of electric, gasoline and horse-drawn trucks. The research has been undertaken by the electrical department of the school. The funds were available in May, 1911, for the beginning of the investigation and there has now been issued a report of progress, which is published for the benefit of those interested in the matter, in a Vehicle Research Bulletin, published by the Electrical Engineering Department, Massachusetts Institute of Technology, Boston.

The situation has been looked over and a plan of research has been devised and instituted. Already a large amount of valuable data has been assembled.

The fundamental question to be discussed is, just what are the advantages or disadvantages of electric trucks for real commercial work. It is a field in which very little information is available as to the details in point of costs, and the company, despite its own facilities for making tests, turns to the Institute which has the plant and the working force to make researches whose findings shall be beyond question.

It is a plain business problem that has been taken up by the Technology experts and is in the service performed in the transportation of merchandise within a thickly-populated area—city and suburbs—a service that ranges from the delivery of the small parcel from the department store to the customer's house to the moving of heavy freight from one railway terminal to another. There are available three types of vehicle—horse-drawn, gasoline and electric. It is necessary to analyze the service and note the relationships between each element in it and the cost of operation and repeat this analysis for each type of vehicle. The Technology study has thus far been along two lines, the determination of the demands of the different kinds of service and, second, the study of the relative economy of the three types of wagons when used in any given service.

For the collection of facts, research assistant H. F. Thompson, who has charge of the investigation, has availed himself of special recording devices. These registers furnish tapes on which an oscillating pen draws a line while the tape moves regularly forward. The relations of the pen line to the time lines on the tape tell the story of speed. If the wagon is at rest the line is parallel to the axis of the tape, and in ratio to the rapidity of the motion of the wagon the pen line assumes an angle with this axis.

This ingenious device is a trustworthy detective and has revealed much. The little line tells how much longer than necessary the grocery delivery driver has tarried with attractive Mary, the maid, and how fast he has had to urge his poor horse to make up the time spent with her. It tells the whole story of the movements of the vehicle.

The Technology professors made arrangements with six business firms in Boston to affix registers to their vehicles and three others have recently been enlisted in the research. They are regular business houses, engaged in their regular work with their regular employees. They represent different types of teaming, city pick-up, furniture moving, freight handling, wholesale and retail coal delivery, parcel delivery, bottled goods delivery, the different services of an electric lighting company and miscellaneous hauling. The vehicles vary in size from one-horse to three-horse wagons and in the trucks from seven hundred pounds to five tons. The number of tapes received daily will be presently increased from forty-five to seventy, and these are read and tabulated by Mr. Thompson's staff.

Besides the tapes, forms are used for reports, these giving the conditions of work, the items, and the details of expense including operating, maintenance and fixed charges. There are certain expense factors which the investigation is already clearing up, for example, the cost to the teamsters of congested streets, insufficient railway platforms, etc. The amount of work that a truck can do in a working day is the number of miles that it can go plus the standing time plus the time taken for loading and unloading. The latter is an important factor to cost that is generally overlooked. It is more noticeable when motor trucks are used. To illustrate, a horse-drawn truck with a two-ton load can be counted on for a maximum in city streets of fifteen miles a day, while an electric truck in the same service is good for about thirty-five miles. With the speeds that are practicable, 3.5 miles per hour for the horse and 6.5 miles for the motor, the horses will make their mileage in four hours a day while the motors must keep moving 5.5 hours. There is little gain in a nine-hour day in reducing the standing time of the horses to less than fifty-five per cent of the whole time, while the electric truck must not stand longer than forty per cent of the time.

The ratio of what the truck actually does to what it might do is termed by the investigators the "distance factor." It has been made evident that the larger the distance factor the less the cost per unit of service. It is desirable, therefore, to maintain a large distance factor and the consideration of means to increase it in the various classes of traffic is now under consideration.

While it is perfectly true that mechanically driven wagons have evident advantages in rapidity of movement and radius of action over the horse, still it must not be forgotten that cost proportions are very important. If the expense of handling a given class of merchandise is very small in proportion to other costs, the matter of a few cents a ton for haulage may readily be secondary to such points as reliability and punctuality. It is therefore necessary to the business man that he have the costs accurately determined before selecting the kind of truck. It is really true that the horse may have his advantages for delivery service if the business is such that he can fit into it.

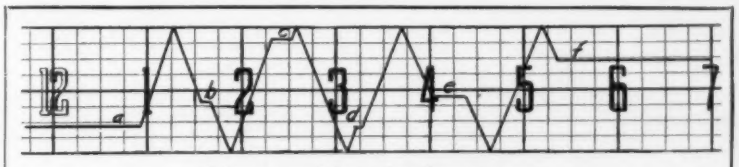
One matter which this investigation has brought out, and which is important to the business man, is the general lack of uniformity in accounts. In one case the drivers' wages were not included in the teaming costs; there is usually no charge for garage, although there should be such a one, even if the teamster keeps his auto-truck in a shed in his yard. Insurance and taxes are usually omitted, while amortization, administration and interest are sometimes not included. It is difficult, therefore, save in some such clearing house as this, to make a proper comparison, and the greater part of the comparisons have been without a common foundation, so that many users of vehicles have been misleading themselves with reference to operating expenses through such omissions.

Delay at freight stations in Boston is an important matter which has hitherto received no scientific consideration. This is important according to its relation to the length of haul, and here the wholesale districts are comparatively near the freight sheds. A group of students is distributed throughout the freight district, gathering the actual facts.

The first thing that suggests itself as an outcome to the investigations up to date is that "Service requirements are as important a factor in determining costs as is the type of vehicle selected." Every class of service must be considered by itself.

For parcel delivery, nine-hour day, three trips, four parcels delivered per mile and with one minute consumed in each delivery, three-quarters of an hour being allowed for loading and the maximum load being half a ton, the horse-drawn vehicle does only two thirds as much work a day as the electric or gasoline truck, at a cost per delivery of 5.9 cents, 5.4 cents and 6.5 cents, respectively. The cost per mile by horse is likewise between the two other costs. In the delivery of coal, which is a very different kind of delivery, at the heavy end of the scale, with loads of five tons, the horse wagon (three horses, one resting every third day) does only about half as much work per day as either of the motor trucks. The cost per mile here runs in much the same way as with the light work, being 55 cents for horses, 47 for electrics and 58 for gasoline, while the costs per delivery are in the same order, $3.91, against $3.32 and $4.07.

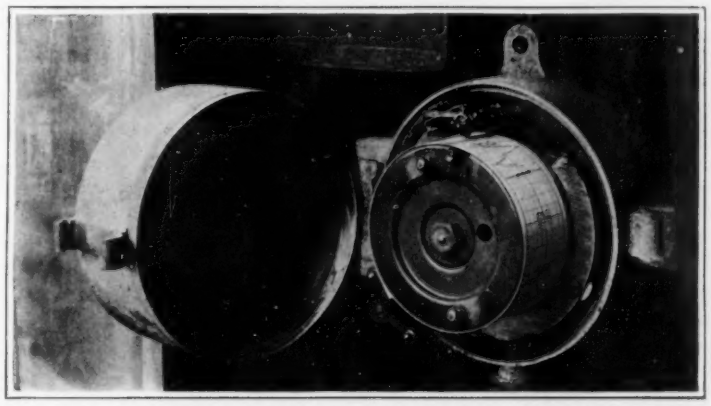
Some experiments have been made in special service requirements as affecting the cost of operation, and for the parcel delivery two minutes per call has been allowed instead of one. This increases the standing time, reduces the mileage per day, lessens the distance factor and raises the cost of delivery.



A tape record for a two-horse wagon.

The heavy pencil line records the movements of the wagon. Where the line is inclined the wagon is moving; the slope is proportional to the speed; where the line is horizontal the wagon is standing still. The horizontal distances are proportional to the time. Each tape is analyzed by noting the total time the wagon was in use during the day, the time standing still, distances traveled, speeds during the morning, mid-day and afternoon, total number of stops, and any special items which apply to the particular work the wagon is doing. Below is the interpretation of the record:

Stops.	Speeds.	Distances
a. Batchelder's Wharf, Dinner	— — — — — — —	— — — —
b. Brookline, Loading	*a-b* 4¼ miles per hour	*a-b* 2.7 miles
c. Batchelder's Wharf, Unloading	*b-c* 4 miles per hour	*a-c* 5.4 miles
d. Brookline, Loading	*c-d* 4 miles per hour	*a-d* 8.0 miles
e. Batchelder's Wharf, Unloading	*d-e* 3¼ miles per hour	*a-e* 10.7 miles
f. Stable	*e-f* 3½ miles per hour	*a-f* 14.2 miles



An open indicator which was attached to a large motor truck.

The marks across the tape are quarter hours; the figures indicate the hours; the lines around the drum mark quarter miles. The position of the pencil shows that the photograph was taken at 2:30 and that the wagon had then been standing about forty minutes.

The speed indicator is here shown in place beside the lamp.

How the Germans Utilize Waste—VI

Wealth That Has Been Earned By the Efficient Use of Raw Material

By Waldemar Kaempffert

(Concluded from page 534, June 15th, 1912)

[*THIS is a continuation of an article that was begun in last week's issue. It is the sixth of a series of articles prepared by the Managing Editor of the* SCIENTIFIC AMERICAN *on European industrial conditions. The author was sent to Europe by the publishers of the* SCIENTIFIC AMERICAN *for the purpose of studying the application of science to business abroad. So much have the Germans done in the application of scientific principles to the utilization of waste, that little more can be done than to give glimpses of a small part of a vast field that they have so admirably covered.*]

Making Precious Stones With Waste Gas.

At Bittersfeld, electrolytic hydrogen is also used for the production of artificial gems. At the beginning of the present century, Verneuil, of Paris, succeeded in devising a process of making synthetic rubies, and another Frenchman, Michaud, in the middle of the nineties, succeeded in making what are known as "reconstructed rubies" out of natural ruby fragments. Almost at the same time a German gem polisher named Herman Wild of Idar, began to make real artificial rubies. Later he collaborated with Prof. Miethe. They developed a process which was eventually adopted by the Bittersfeld works. In that process, hydrogen plays an important part. Not only are real rubies thus made, but genuine sapphires, topaz, and other precious and semi-precious stones. These products must not be regarded as mere imitations of real gems, but as genuine precious stones.

Germany's annual potato crop is somewhere in the neighborhood of 45,000,000 tons. The supply is considerably in excess of both household and industrial demands. New channels had to be found to use up the surplus profitably, and if possible, to save a portion of the 10 per cent of the total crop which annually goes to waste through decay and the lack of proper winter storage. About eleven years ago the German Association of Alcohol Manufacturers, the largest industrial consumers of potatoes, took this task upon themselves. They organized a branch of their association to be known as the German Potato Driers' Association and assigned to it the task of studying methods of using dried potatoes in the various forms in which they could be produced. To increase the general interest in this question, the Alcohol Association succeeded in raising from interested sources, including two subscriptions from the government, the sum of 30,000 marks to be distributed as prizes for the best methods of reducing potatoes to an available stock food. Of the forty entries received, only twenty-two failed to answer the requirements. One of the most successful systems proved to be a method of washing the potatoes, steaming them, and passing them between two rollers, heated to 284 deg. Fahr., then removing the dried and crushed substance from the rollers by knives and passing it through a cooling funnel, after which it is ready for storing. The surplus supply of potatoes is thus worked up into a nourishing animal food.

Generating Power from Sewage.

The city of Berlin affords an excellent illustration of the enormous development to which the pursuit of sewage disposal by sewage farming has led. The city itself covers an area of about 20,000 acres; its sewage farms are no less than 40,000 acres in extent. In a way the Berlin sewage farm is a gigantic real estate speculation. Ultimately the city will sell the sewage farm land at a large profit and turn to modern biological methods.

Our present mode of disposing of sewage by pouring it into streams is exceedingly wasteful. It represents so much nitrogen which has been extracted from the soil, and which ought, by right, to be returned to the soil. If it could be advantageously used, it would represent a value of about $200,000,000 a year to England alone. This, however, is distributed over a quantity of three billion tons. Sewage is so complex in its nature that the recovery of its chemical constituents would be almost a hopeless task. That, however, is no reason why some method should not be devised of utilizing it as a fertilizer. As a general rule, the sludge is dumped on land which has been bought for the purpose, but in many European towns land suitable for that purpose is nearly all filled up. Consequently it is a serious question what shall be done when no more land is available. Farmers have endeavored to use the sludge as a fertilizer; but that is not always practicable, partly because of the chemical character of the sludge and partly because of the farmer's distance from the dumping ground.

Experiments carried out at Bruenn have shown that sewage sludge, after it has been dried until it contains 25 per cent of dried substance, is superior to most animal fertilizers in its content of nitrogen and of phosphoric acid. As the quantity is too great to be disposed of locally, it has been successfully used after complete drying for the production of lighting gas.

Making Clothes Out of Wood.

From Germany we can learn how to make the most out of a tree in an industrial way; for in Germany a tree which as a cord of wood is worth little more than three-fourths of a cent to a cent a pound, is converted into artificial silk worth $2 a pound, and into artificial bristles of cellulose acetate worth $4 a pound. Thanks to the German chemist, trees may now serve to clothe a man. A whole industry has sprung up in the last decade for the express purpose of scientifically converting wood into cloth—wood, moreover, which would otherwise be wasted in fashioning round tree trunks into rectangular boards, and beams. In Saxony, for example, a yarn called "xylolin" is made from paper as well as directly from wood pulp. From that paper, yarn, twine, cord, carpet, imitation canvas, and even whole suits of clothes have been made—all of them proof against the action of both hot and cold water. A large corporation has built a factory not far from Berlin for the purpose of making "silvalin" yarn from spruce, of which there are fairly large tracts in Germany. Like its cousin "xylolin," "silvalin" can be woven in the loom to produce whole pieces of cloth which in their essence are nothing but transformed trees.

The whole German cellulose and nitro-cellulose industry is a brilliant example of what efficiency means in the utilization of wood. The production of artificial silk from wood is alone a triumph of the application of science to industry. The credit for the original discovery belongs to Chardonnet. The process that he devised has not been very radically changed to this day. An ether-alcohol solution of nitro-cellulose is employed. At first the liquid was squirted through a fine opening, the resulting thread congealing in cold water. Each thread was composed of a tube with a liquid interior. As it emerged from the fine opening, it was rather coarse, but it was spun into a thin filament later. Nowadays very fine openings are used, as small as 8/800 of a millimeter.

In the last twenty years, Germany has built up a huge industry on cellulose derivatives. All of them cannot even be mentioned here. In the manufacture of incandescent mantles, both for coating the mantle to enable it to withstand the shock of handling, and in the production of mantles themselves by the ejection of filaments containing the thoria and ceria, to be afterward woven into mantles; in the production of pyroxylin for imitation leathers and the manufacture of continuous film (an improvement which has undoubtedly contributed more than any other discovery to the popularity of photography and especially of the moving picture)—in all these we find that cellulose is nowadays employed as a vital necessity. Little did Schoenbein dream that the gun cotton (nitro-cellulose) which he had invented would find far greater application in the arts of peace than in the art of war. Thanks to his discovery many articles hitherto made from expensive natural products are now made chiefly from wood waste. Between five thousand and six thousand patents on nitro-cellulose and its uses are now to be found on the records. Even the scientist has benefited by the wider application of cellulose. Museum specimens are now prepared with it, particularly sections for the microscope; important documents are preserved by means of it; special tubes for deep sea sounding are made of it, the tubes being coated inside with silver chromate. All these are minor but still important applications of nitro-cellulose solutions.

Artificial Wood.

Many a large building in Germany is floored with a material which is obviously not cement, because it is not hard enough, nor linoleum because it is not quite soft enough despite its elasticity. Ask an architect what that curious material is and you will be told that it is pressed sawdust mixed with magnesium chloride. Wood is too expensive in Germany to be burned under a boiler—the American method of utilizing most sawmill waste. Hence the sawdust floor. We in the United States have not been blind to this new use of what was once a waste; for the German manufacturer will tell you that the American too is beginning to mix his sawdust with magnesium chloride. Like most German industries, however small, the process of making a flooring from sawdust is conducted on strictly scientific principles. Something more than a haphazard mixture of sawdust and magnesium chloride is required. The chloride absorbs water very readily. It is what the chemist calls hygroscopic. Unless some scientific method is adopted to effect the mixture, a perpetually damp floor will be the result. Accordingly, the manufacturers have employed chemists to solve that problem for them. It is the business of the chemist to ascertain the correct proportions of the mixture. The usual process is to add the sawdust in the right quantity to a cement-like mass composed of a solution of magnesium chloride to which powdered magnesia is added. Sometimes the manufacturer delivers tiles of this composition, and sometimes he mixes the composition on the spot, works it in the form of a plastic mass, and allows it to set. The cost is rarely greater than $2 a square yard. The effect of linoleum and parquet flooring is obtained by adding coloring matter. Even wainscoting, stair coverings, and roofing tiles are thus made. One manufacturer supplies the raw material itself and the formula for mixing it, so that you can lay your own floor, and exercise your own ingenuity and good taste. Some of these artificial wood floorings and wainscots are made from bottle corks. Perhaps that explains why the waiters in every German hotel have developed a squirrel-like faculty of treasuring cork stoppers.

The Manufacture of Soda.

There is a rivalry in applied chemistry in Germany that is just as keen as business rivalry. A brilliant example is to be found in the competition between the LeBlanc, the Solvay, and the electrolytic process for the production of soda from waste. A capitalization of $25,000,000 was practically wiped out in the last ten years in Germany when Solvay succeeded in placing the ammonia-soda process on its commercial feet by inventing suitable apparatus to compete with the LeBlanc process. A few factories managed to save themselves by turning to other fields; for example, a factory near Stettin started in to manufacture superphosphates in its sulphuric acid plant. In Aix-la-Chapelle, however, an ingenious chemical engineer succeeded in so far improving the old apparatus, that the LeBlanc process is still worked there with commercial success. The same holds true for Heinrichshall. The struggle between the LeBlanc and the newer processes was even keener in England. Forty-five factories were threatened with extinction. They united together to form the United Alkali Company. By increasing the efficiency of the old LeBlanc process, and by utilizing to the utmost such by-products as hydrochloric acid, chlorine, sulphur and chlorate, for which there was a great demand in England and the United States, they managed to keep their heads above water and to make money. What is more, they also succeeded in assimilating the new processes. A curious change in values of the individual products has taken place. Hydrochloric acid, which at one time was simply driven off into the air, to the intense disgust of the vicinity, or run into the sea, soon became the financial pivot of the entire undertaking. Sulphur, which combined with calcium, accumulated in great heaps or was poured into the sea with the waste dye, was afterward exported by the hundred-weight to America.

Very justly the LeBlanc process has been called the high school of all industrial chemical work. The process was of no use to such young countries as America, Italy, Russia. They had no means of disposing of the by-products which have now become actually main products. For their need the extraordinarily simple and cheap method of the ammonia-soda and the electrolytic processes are wonderfully efficient. Thus, even in Italy, which has begun to develop its water powers of recent years, these processes can be carried out commercially if the chlorine is disposed of in some way. The textile industries have thus far proved the chief consumers of the chlorine. The alkalis, on the other hand, are absorbed in enormous quantities by the textile, soap and candle industries. The result is that a good deal of soda must still be imported. Hence, it is a matter of vital importance to find a new outlet for the chlorine.

Correspondence

[The editors are not responsible for statements made in the correspondence column. Anonymous communications cannot be considered, but the names of correspondents will be withheld when so desired.]

Motor Substitute for a Horse Wanted

To the Editor of the SCIENTIFIC AMERICAN:

Let me ask the inventors who read the SCIENTIFIC AMERICAN to consider the needs of the small farmer in the matter of tractors. The farmer who owns a thousand acres is well provided, or may be at a reasonable price, but the man who owns a small place, and more especially the market gardeners, of whom I am one, must depend on the horse or hand work. I have asked three companies, making tractors for large farms, to consider our needs, but each one answered that the shops were driven to capacity to fill orders for the kind now building, and there was no possibility of adding a new variety at present. Each expressed approval of the idea, however, and two said there was no doubt a tractor of the kind would eventually find an enormous sale.

I will venture to offer a suggestion as to what might serve. As we need a substitute for a single horse, I fancy that a motorcycle having a drive wheel from 18 to 20 or 24 inches wide might do the business, especially if it had a tire of solid rubber blocks like some motor-trucks. Such a cycle might be hitched to a plow or harrow or a light wagon, I should think. It even seems to me that two might be hitched up side by side like a team of horses. Two miles an hour is ample speed for plowing, and from three to five miles for use on the highway.

I observe that the best motorcycles sell for $200 and $250. Is it not possible to build a tractor on the same principle and sell it at the same price?

Little Falls, N. Y. JOHN R. SPEARS.

Curbing the Wireless Meddler

To the Editor of the SCIENTIFIC AMERICAN:

After reading the communication of Donald P. Beard in the issue of May 4th, I am still inclined to hold my ground and will try to further prove the assertions made in my first letter in regard to your article entitled: "Curbing the Wireless Meddler."

I will not attempt to disprove the statement that wireless amateurs prevented the Siasconset station from getting news from the "Carpathia" for forty-eight hours, as I do not wish to make any statements which I can not absolutely prove. However, it is interesting to note the following:

1. The "Carpathia" is listed in the Official Wireless Blue Book, published by the United States Government, as having an effective sending range of only eighty-five miles. I wonder if the true reason why the operators at Siasconset could not pick up the "Carpathia" was not because at the beginning of the forty-eight hours the "Carpathia" was over ten times her actual sending distance away from the Siasconset station?

2. The operators on the "Carpathia" were under a censorship, and absolutely refused to send any news of the disaster to any of the different stations that were able to communicate with her.

3. I cannot seem to picture the wireless amateur who has the endurance to interfere for forty-eight consecutive hours.

The contents of the original article, "Curbing the Wireless Meddler," which provoked this controversy, indicate that the same was inspired by the alleged amateur interference when the "Terry" was in distress. Since writing my first letter, I have acquired some information which proves that there was absolutely no interference at the time stated, except one small case, in which one amateur called another. He was immediately requested to keep out, and no more was heard from him or any other amateur during the trouble with the "Terry." Furthermore, the first news that the Brooklyn navy yard had of the "Terry's" distress was picked up by an amateur in Bayonne, N. J., and relayed to the Government operator. I get this information from a letter published in the *Electrician and Mechanic* for May, and inclose the same herewith. Kindly take note of the fact that Mr. Charles E. Pearce, the writer of the letter, is willing to make affidavit to the effect that all the entries upon his record are true, and that nothing has been omitted. Mr. Pearce's letter seems to prove beyond a doubt that there was no interference in this instance; yet, since for some reason or other the naval operators could not do their work properly, the poor amateur got the blame. If the case of the "Carpathia" was thoroughly investigated, it would probably be shown that there was no more amateur interference than there was in the case of the "Terry." It seems to be a popular excuse for authorized operators to blame the amateurs for all their troubles, no matter what the true cause may be, and the uninformed public accepts it as the truth.

Mr. Beard alludes to my statement, that the Government employs antiquated instruments, as being false and groundless, but he does not back up his assertion. Probably he could answer the following questions:

1. Why can the majority of amateurs of this city pick up messages from longer distances than the naval station, which is equipped with an aerial five to ten times longer than theirs?

2. Why can the amateurs and commercial stations work with one another, when the Government stations have to shut down on account of interference?

3. Why can amateurs in Washington read Piver's Island on many occasions, when the naval station has to have them relayed by way of Norfolk?

4. Why do the majority of amateurs here get long distance signals louder than the Government station?

5. Why can the amateurs read official messages the first time sent, when the Government operator must have them repeated, on account of interference?

There are only two answers. Either they do not employ efficient tuning apparatus or the operators do not understand the manipulation of their own outfits. The Marconi, Fessenden, and De Forest companies all have patented systems for the cutting out of interference, each one of which has proved its worth. Why does not the navy adopt one of these systems and thus put a stop to their troubles? Is it because they need the money?

I still contend that to deprive the wireless amateur of his apparatus would put a strong hindrance on the advancement of the art, as many patents have been granted to them in the last three years, which could not happen if the experimenter were put out of business.

Washington, D. C. EDWIN L. POWELL.

The Mattullath and Wright Aeroplanes Compared

To the Editor of the SCIENTIFIC AMERICAN:

In your issue of April 20th, 1912, you referred to the Mattullath aeroplane patent application, filed January 8th, 1900, which had just been revived and reinstated among the pending applications in the Patent Office by order of the Court of Appeals of the District of Columbia. The following facts will, it is believed, be of interest to those of your readers familiar with the progress of the aeroplane art:

The Mattullath invention was brought to public notice about three years ago by the defendants in the suit of the Wright Company against the Herring-Curtiss Company for infringement of Wright's patent, No. 821,393, filed March 23rd, 1903. The Curtiss Company claimed that that application disclosed a construction which would anticipate the broad claims of the Wright patent, and its counsel applied to the court for a certificate upon which to secure a copy from the Commissioner of Patents. In granting the certificate the court ruled that the application in question would be material evidence for the defendants,

"if said application discloses a flying-machine (whether heavier-than-air or not) which has rudders or plane surfaces at the side of the central axis of the machine which may be moved so as to tilt the machine back to the normal horizontal, if one side thereof is tipped up or down from the horizontal."

A certified copy of the application having been introduced in evidence, however, the court held that as it was an *abandoned* application, it had no legal effect, and therefore could "only be regarded as an unsuccessful experiment." As by the decision of the Court of Appeals of the District of Columbia, this application has been finally adjudicated as not abandoned, and is now in full force as a pending case, we make the following comparison between the Mattullath invention and the Wright machine covered by the patent in suit.

THE WRIGHT AEROPLANE.

The Wright patent specification states:

"Our invention relates to that class of flying-machines in which the weight is sustained by the reactions resulting when one or more aeroplanes are moved through the air edgewise at a small angle of incidence, either by the application of mechanical power or by the utilization of the force of gravity.

"The objects of our invention are to provide means for maintaining or restoring the equilibrium or lateral balance of the apparatus, to provide means for guiding the machine both vertically and horizontally," etc.

Then, following a detailed description of the Wright machine, it is stated:

"By reason of this construction it will be seen that with the particular mode of construction now under consideration it is possible to move the forward corner of the lateral edges of the aeroplane on one side of the machine either above or below the normal planes of the aeroplanes, a reverse movement of the forward corners of the lateral margins on the other side of the machine occurring simultaneously." . . . "We wish it to be understood, however, that our invention is not limited to this particular construction, since any construction whereby the angular relations of the lateral margins of the aeroplanes may be varied in opposite directions with respect to the normal planes of said aeroplanes comes within the scope of our invention." . . . "In connection with the body of the machine as thus operated we employ a vertical rudder or tail 22, so supported as to turn around a vertical axis." . . . "We wish it to be understood, however, that we do not limit ourselves to the particular description of rudder set forth, the essential being that the rudder shall be vertical and shall be so moved as to present its resisting-surface on that side of the machine which offers the least resistance to the atmosphere, so as to counteract the tendency of the machine to turn around a vertical axis when the two sides thereof offer different resistances to the air."

Following a description of the horizontal rudder, it is stated:

"By regulating the pressure on the upper and lower sides of the rudder through changes of angle and curvature in the manner described, a turning movement of the main structure around its transverse axis may be affected, and the course of the machine may thus be directed upward or downward at the will of the operator and the longitudinal balance thereof maintained."

In the cut of the Wright machine reproduced from Fig. 1 of the patent, the vertical rudder is marked 22 and the horizontal rudder 31. The structure of the actual Wright machine in the cut is more elaborate and shows somewhat different vertical and horizontal rudders, but the general characteristics of the machine are the same.

The broadest claim of the patent in suit, which it is asserted Curtiss infringes, reads as follows:

"7. In a flying-machine, the combination with an aeroplane, and means for simultaneously moving the lateral portions thereof into different angular relations to the normal plane of the body of the aeroplane and to each other, so as to present to the atmosphere different angles of incidence, of a vertical rudder, and means whereby said rudder is caused to present to the wind that side thereof nearest the side of the aeroplane having the smaller angle of incidence and offering the least resistance to the atmosphere, substantially as described."

THE MATTULLATH AEROPLANE.

The following is a summary of the principal statements of Mattullath in the specifications of his application:

"Enough has been accomplished up to the present day to demonstrate the possibility of dynamic flight upon the principle of the aeroplane propelled at an angle to the direction of flight.

"My invention embraces certain novel features of construction for insuring the stability of the device, *for steering it in any direction at the will of the operator* and for rising from the ground and for landing."

"*C* are movable aeroplanes overhanging the sides of the cars *A*. They are secured to shafts *D* journaled in suitable bearings and are adapted to be set at any desired angle by means of levers *D'* or other suitable means under control from within the cars.

"Above the deck *E* are supported the aeroplanes *O*, preferably arranged in separate groups placed fore and aft and on opposite sides. These aeroplanes are constructed in the same manner as already described for the other aeroplanes, that is to say, they present a sharp edge at the forward end and all the structural parts necessary to give material strength and thickness are concealed within the upper and lower surface. These aeroplanes are supported on suitable stanchions *P*, to which the aeroplanes are secured in any suitable manner which will permit of their being adjusted to various inclines within the limit of a few degrees.

"*Q'* is a rudder secured on a vertical shaft *R* and extending above and below the deck *E* substantially the whole height of the superstructure above the cars.

"The adjustability of the aeroplanes *O* and their arrangement in groups fore and aft and to opposite sides of the longitudinal center permits of trimming the structure for its normal flight, while the movable aeroplanes *C* are for *steering the machine in the vertical plane as well as for maintaining the stability.*

"For starting on solid ground and landing thereon, I intend to place suitable wheels under the cars.

"By having two long and widely separate cars which also represent the greater portion of the weight, great lateral stability is gained in flying and at the same time it permits of rising from and landing on the water."

From the foregoing it is apparent that Mattullath disclosed in his application the independently movable ailerons for maintaining lateral stability in flight as well as a vertical steering rudder (this rudder was claimed as a material element of the Mattullath combination in original claim 20, being designated as "a vertical steering rudder") to steer the machine in a vertical plane.

The Mattullath construction is undoubtedly far more analogous to the Curtiss type of machine, in that the ailerons are not connected to the independent vertical steering rudder as is the case in the Wright machine, but the means for operating the ailerons and the vertical rudder are under the independent control of the operator. In this connection, however, the decision in the case of Wright Company v. Paulhan (177 F. R., 261) is of no little interest, since it is therein specifically held that these two methods of control are in effect equivalent, it being held:

"The Wright patent, No. 821,393, for a flying machine covers a combination of elements, one purpose of which is to maintain or restore the equilibrium or lateral balance of such a machine of the heavier than air type. The machine consists of an aeroplane having two lateral wings or planes capable of being moved into different angular relations to the normal plane of the body of the aeroplane and to each other so as to present to the atmosphere different angles of incidence, in combination with a vertical rudder, and the entire combination is intended to be effective as a means whereby the rudder is caused to present to the wind that side thereof nearest the side of the aeroplane having the smaller angle of incidence to the atmosphere, thus correcting the tendency of such difference of angle to throw the machine out of lateral balance. The specification and drawings *show the tiller rope of the vertical rudder attached to the warping rope* which runs along the rear of the lower plane of the biplanes in such wise that when the marginal parts of the two planes are warped into different angles of incidence, the rudder is turned automatically toward the margin having the lesser angle. HELD, that such attachment is but *one* of the means by which the combination may be made effective for its purpose, and that *tiller ropes under the independent control* of the operator are *equally such a means* and an obvious modification within the scope of the patent.

"The fact that the vertical rudder of such combination when *detached* from the warping rope *is capable* of being used as a steering device, and that it is so used in a machine not made under the patent, does not avoid infringement where it is also capable of being used and is used as a part of the patented combination for the purpose of maintaining equilibrium." (*Italics* ours.)

New York, N. Y. MERWIN & SWENARTON.

Miss George showing children how to spell and space words made from cardboard letters. Two cases contain in various compartments all the letters cut in script. Five complete alphabets are used.

Plane geometrical insets in wood are used. In the education of the stereognostic sense, the insets are mixed up and the child puts them into place by sight and by touch.

What is the Montessori Method?

Application of Science to Education

By Sidonie Matzner Gruenberg

THE application of scientific methods to problems of education has been going on for a long time, but none in this field has heretofore appealed to the popular imagination as has Dr. Maria Montessori. This woman, trained as a physician and experienced in methods of scientific research, made her opportunity to observe feeble-minded children under medical treatment her point of departure in educational theory. In the nineties there was a tendency among those studying mental defectives to resort to special gymnastics for the treatment of these cases. Dr. Montessori at that time emphasized the importance of pedagogical rather than medical treatment for such children. In 1898 she presented her views at the Pedagogical Congress at Turin and immediately received the recognition of the leading educators. Shortly afterward she was invited to address the teachers of Rome on her ideas on training feeble-minded children, and there was then established an all-day school for children who were considered hopelessly deficient, which was placed in her charge.

During all this time Madame Montessori felt that the methods used with feeble-minded children were not in any way such as to exclude their application to *normal* children, and there grew upon her the conviction that the methods in ordinary use were far from being suitable for *any* children.

She therefore undertook a thorough study of pedagogy in all its branches with a view to preparing herself for a systematic test of her theories. In the works of Seguin and Itard, Dr. Montessori found material for developing her ideas of reforming the schools and stimulus to further effort.

There is nothing distinctive about Dr. Montessori's views that the development of the child must come through his spontaneous expressions and activities. All the pedagogues, beginning with Rousseau, demanded liberty for the child. However, on the part of the educators of the past this desire for liberty was a vague intuition; they knew it was essential to normal development, yet they had no means of establishing it when they were concerned with groups. Dr. Montessori, making use of the results of the modern psychology and pedagogy, has worked out a method which is remarkably effective with young children.

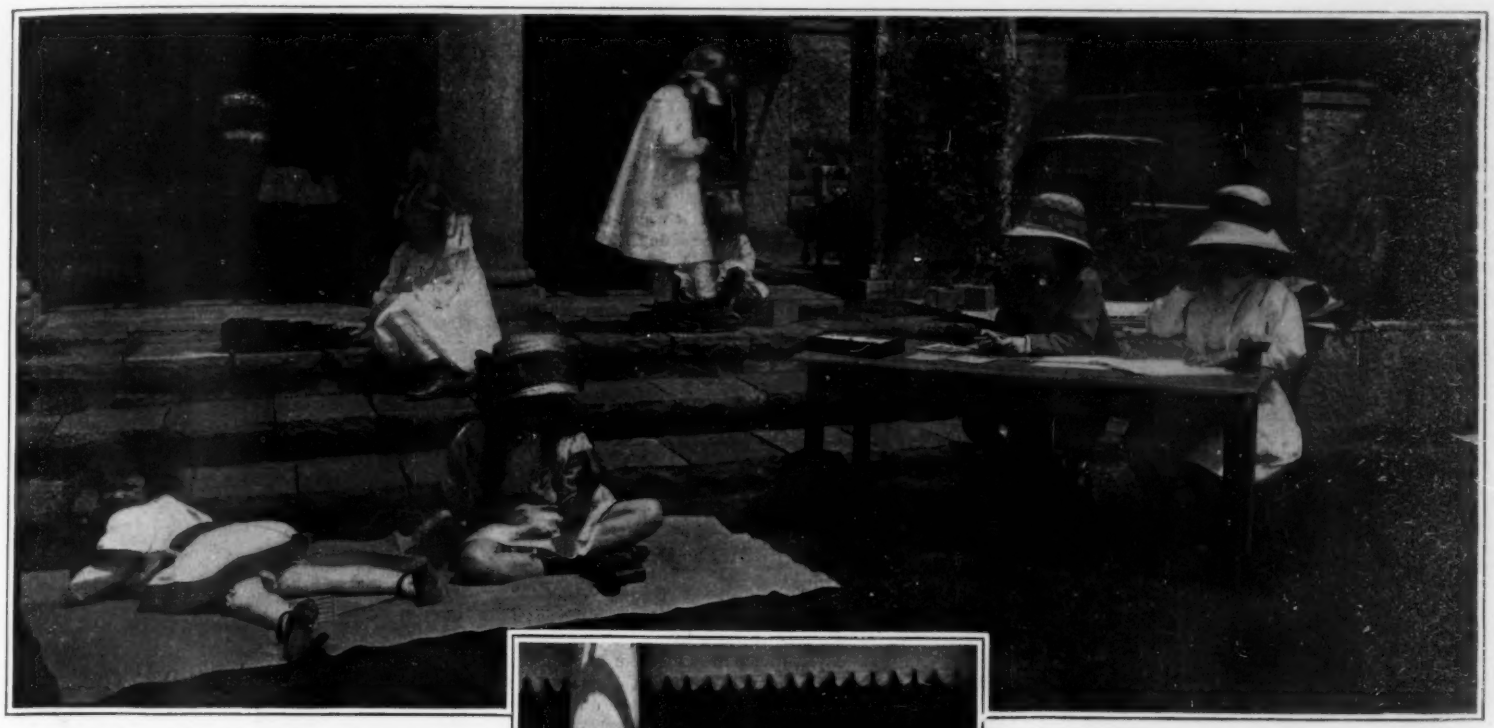
Inasmuch as we have not known how to keep groups of children occupied and happy and free, we have felt compelled to suppress their initiative, organize them into inactive classes and pour dismal knowledge into them. The result has been that the children "confounded immobility with goodness and activity with evil." "The liberty of the child," says Dr. Montessori, "has as its *limit* the collective interest; as its *form*, what we universally consider good breeding. We must therefore check in the child whatever offends or annoys others, or whatever tends toward rough and ill-bred acts. But all the rest—every manifestation having a useful scope—whatever it be, and under whatever form it expresses itself, must not only be permitted, but must be observed by the teacher."

The essential feature of the method, so far as the teacher is concerned, is that the children in action are to be studied by the teacher in the scientific spirit. The teacher must not treat the class as a group of passive beings to be *taught*, but must have toward each individual the attitude of the experimental biologist. She must discover how the child reacts to different kinds of stimuli, what he can do, and the effects upon him of various changes in his environment. This ideal of the function of the teacher is unique. She considers "a room in which all the children move about usefully, intelligently and voluntarily, without committing any rough or rude act, a classroom very well disciplined indeed."

In order to carry out these ideas there are needed a school and materials. The first opportunity Dr. Montessori had to try out her plans was afforded by the remodeling of a group of tenements in Rome. The plans for these tenements included a room in which the children of the tenants could be gathered during the day while their parents were away at work. The play and work of these children was to be carried on under the direction of a teacher, who was to have her own residence in one of the apartments. The "House of Childhood" has a twofold significance: "The social importance which it assumes through its peculiarity of being a school within the house, and its purely pedagogic importance gained through its methods."

To teach the child how to discriminate objects according to thickness, height and size geometrical solids are employed. In this picture Miss George is shown teaching children to determine by the sense of touch the shape of various objects.

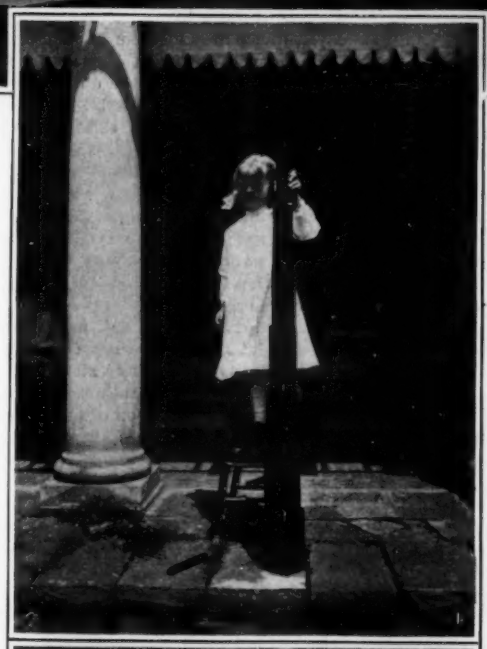
It is impossible here to dwell upon the full social significance of the houses of childhood, although it is well worth thoughtful consideration. On the pedagogical side Dr. Montessori has made many interesting experiments, but several points are of special interest. First of these, for social as well as for pedagogical reasons, is the fact that she admits to her school children much younger than have usually been placed under systematic school work, even in Kindergartens. She and the teachers trained by her have successfully managed groups of children from two and a half to six years of age without placing them under formal restrictions. Each child is free to pursue the activity that interests him most for the time being, and is free to change as frequently as he may wish. The good order maintained in the class without resort to any form of regimentation is due very largely to the fact that provision is made for interesting activities with special apparatus. This material is designed in order to meet the child's need for certain manipulations and activities and is so arranged as to give a thorough training of all the senses. For the most part this material is self-checking. For example, there are blocks of wood with holes of different sizes and a series of cylinders with metal knobs to fit these holes; the child tries to place each cylinder in the appropriate hole; if he makes



A glimpse of Miss Anne E. George's school conducted on the Montessori principle, at Tarrytown, N. Y.

one mistake the set cannot be completed. With this apparatus the child working by himself learns to discriminate proportions. A large number of insets of various forms and sizes enables the child to learn through his own activity to discriminate geometrical figures and dimensions. Special material is used for exercising each of the senses, and Dr. Montessori lays particular stress on the training of the sense of touch, which she feels has been too much neglected.

Her method of teaching writing is tremendously suggestive, and grew out of the difficulties encountered by an idiotic girl trying to learn darning. Dr. Montessori observed that this feeble-minded girl had no control of the needle, and gave her the paper weaving mats designed by Froebel. The girl learned to work with the paper strips, and having acquired the necessary movement for darning, was able to do it with a needle when this kind of work was again presented to her. From this experience Madame Montessori concluded that before learning a difficult art, such as sewing or writing, the child should be prepared by suitable exercises. She then analyzed the process of writing and found two essentially distinct sets of activities, namely, the manipulation of the tool and the tracing of the outlines. Her children learn to handle the writing instrument by tracing outlines around the geometrical insets with a colored crayon selected by themselves, and then filling in the empty space, all the time holding the pencil as in writing. They thus acquire control of the instrument without actually writing. For acquiring "the muscular memory of the movements necessary for writing," and at the same time a visual knowledge of the forms, she gives them letters cut out of sand paper and mounted on card board; the children pass their fingers over these outlines in the same direction in



At this school, each child is permitted to do whatever happens to appeal to her. No restraint is imposed.

which the letters are formed in writing.

"The average time that elapses between the first trial of the preparatory exercises and the first written word is, for children of four years, from a month to a month and a half. With children of five years, the period is much shorter, being about a month. But one of our pupils learned to use in writing all the letters of the alphabet in twenty days. Children of four years, after they have been in school for two months and a half, can write any word from dictation, and can pass to writing with ink in a note book. Our little ones are generally experts after three months' time, and those who have written for six months may be compared to children in the third elementary. Indeed, writing is one of the easiest and most delightful of all the conquests made by the child."

Contrary to common usage in school Dr. Montessori taught the children to write before teaching them to read. Having done this, and dealing with a strictly phonetic language, teaching the children to read did not present many difficulties.

It is no easy matter to compare the work done by Madame Montessori's classes with that made familiar to us in our schools. Due to the fact that she teaches reading and writing we compare her work with that of the primary grades, and there indeed the contrast is very great—no desks, no restraint, no formal lessons. On the other hand, on account of the ages of the children we are tempted to compare it with the Kindergarten; here the contrast is not so great, the chief difference being in the attitude of the teacher. In the Kindergarten, the great variety of the material makes it necessary for the teacher to give much of her time to looking after this instead of to observing the children. In

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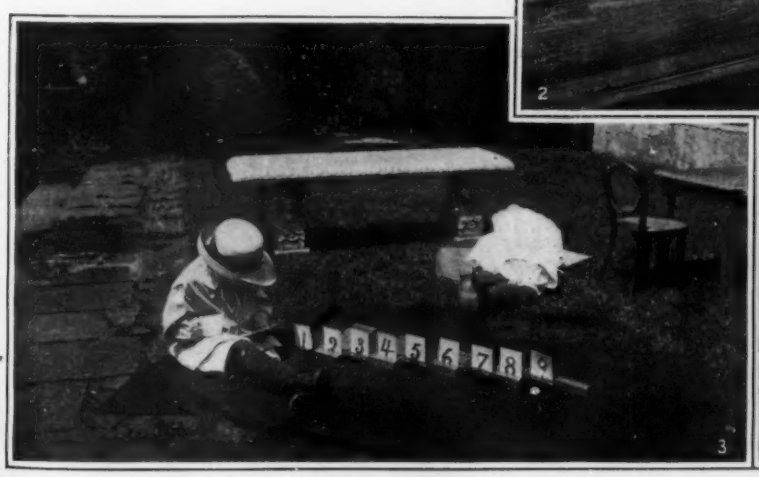

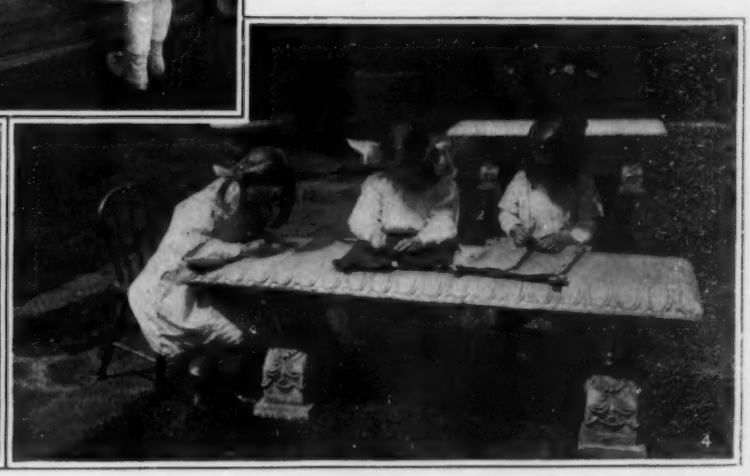

1. By means of a series of blocks, decreasing in height and width, a child can exercise itself for visual perception of differences and dimension. 2. By means of a set of duplicate color boxes the child acquires a most exquisite appreciation and knowledge of colors. There are eight colors, each presented in a series of eight shades. A great variety of games is made possible by these two boxes. 3. The "Long Stair" is the foundation for the introduction of arithmetic. A number of rods, bearing alternating colors, are mixed. The teacher first constructs the stair, calling the child's attention to the colors. Then the child is permitted to build the stair alone. 4. The child on the left is painting with water colors. No restrictions are placed upon her. The other children are using the lacing and buttoning frames, for among the first educational gymnastics used in the Montessori method are exercises for the development of co-ordinated movements of the fingers. Thus the child is prepared for the practical exercises of dressing and undressing itself.

Animal Masquerades

A Demonstration by Abbott H. Thayer of Color Marking and Its Effect

A VERY interesting demonstration recently given in Central Park by Abbott H. Thayer, the well-known figure painter, serves to recall his discoveries of the effect of the markings and coloring of birds and animals—discoveries toward which the naturalists of the old world have thus far turned a more appreciative ear than those of the new.

It is of course an accepted fact that the marks, colors, and appendages of many animals render them inconspicuous when preying or being preyed upon. But naturalists have hesitated and halted before the gaudy colorings of other birds and animals which would seem to make the rule impossible of anything like universal application. Yet these gaudy tints have survived in the midst of enemies. While no adequate reason has been advanced for this survival, many theories have been formulated to account for this remarkable costuming. Some of these are indicated in the phrases "nuptial colors," "warning colors," "signal colors," etc. Mr. Thayer declares all these to be entirely beside the main question. He boldly affirms that such markings are primarily and mainly concealers—even to the gorgeous patterning of the peacock and the brilliant red, black and gold of the coral snake. His demonstrations go far toward proving the truth of his assertions.

Models of a zebra and a donkey among branches, showing how the stripes of the zebra blend better with the branches than the markings of a donkey.

A zebra and a donkey in the underbrush. The donkey is distinctly visible. Find the zebra if you can. He, too, is in the picture.

A zebra in the open. He is distinctly visible, because his stripes do not blend with the surroundings.

It may first be well to examine the simplest aspects of the problem, which follow well-known laws of optical illusion.

The visibility of all solid objects depends upon the fact that their surfaces are seen in varying degrees of illumination. If we conceive of a block of stone placed upon a stage and lighted from above, we must admit the very finest gradations from high light to deep shadow, the brightest part being those receiving the direct rays of the source of illumination, the darkest being those which receive only reflected light. By the skilful application of whitish pigment to the parts in shadow, and dark pigment to those in the stronger lights, an artist may easily make the block well-nigh invisible at a short distance, provided the resultant monochrome match the background. In other words, "pigment may be so arranged on a solid object as to exactly nullify and obliterate the unequal distribution of light upon the object." This is the law underlying protective coloration.

Animals in their natural environs are seen under descending and diffused light, and Nature has done for them what the artist did for the block of stone; she has painted them dark above and light below. Hence Mr. Thayer's first principle is a recognition of the counteraction of light and shade. This is the color principle of by far the larger part of the animal kingdom.

It is not sufficient that an animal be "colored like its background." Such a condition would nearly always lead to instant detection, for the animal would stand out in more or less bold relief. In other words the only way actually to color him like his background lies in this counter-gradation.

Reference has been made to the fact that most animals are dark above and light below. There are exceptions to this rule but, closely examined, they serve to support the main law. Looked down upon from the level of a man's eyes, there are few more conspicuous objects than the white rump-mark of the prong-buck. If the observer will but sink upon his hands and knees, however, and observe this conspicuous badge against the sky, it will puzzle him to tell where animal ends and sky begins. The observer is now under the disadvantages of the wolf and the cougar, whose spring must be rendered much less effective and accurate by this deceptive melting of animal outline into distant sky.

The introduction of eccentric lines or patches of white coloration among or upon dark has the effect of "cutting the form to pieces" as seen against the sky; and it is maintained that even the white patterns of the skunk which to the cricket's and mouse's eye merge him also into the sky are singularly inconspicuous even when seen from above viewed among dead sticks.

Suppose we leave for a time the question of mere shading, and take up that of coloration. The peacock is generally regarded as one of the most gaudy developments of plumage known to the average man. Yet the gold-green of the forest sunlight, the purplish suggestion of leaves in shadow, the copper sheen noticed in sunlit bark and mold, are all so cunningly reproduced and combined in the feathers of the peacock that, under favorable circumstances, he may be said to melt into the forest scene and become a part of it. In fact, it is when dealing with the brighter-clothed animals and birds that Mr. Thayer's demonstrations become most convincing.

He has had some moments of satisfaction in silencing adverse criticism and the objections of stubborn opponents. In one instance a naturalist declared that the coral snake is the most conspicuous object in Nature. The artist placed on bare ground five imitation snakes—one black, one scarlet, one gold, one the color of the earth, and the fifth a good imitation of the coral snake with its bands of scarlet, gold, and black and with its obliterative shadings duly reproduced. The first four were at once picked out from a distance of twelve yards. But the coral snake entirely escaped the naturalist's eye. This, too, under what he himself admitted to be the most favorable conditions for detection. His gaze had been directed to the very spot, and the objects were all displayed upon a bare, open space.

One finds among butterflies some of the brightest of colors, and a really brilliant butterfly is conceded by naturalist and layman to be as compellingly attractive

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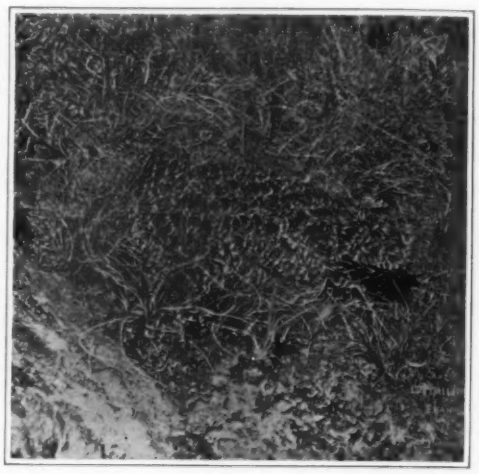


Rocky mountain white-tailed ptarmigan on her nest. This picture shows the nearly perfect "obliteration" of the series, and is a remarkable photograph.

The surroundings of this rattlesnake have been made wholly by copying the snake's own color "values," by perceiving what scene he represents, and using each of his "notes" for the right detail of the scene. The result is an astonishingly true rendering of the stones he frequents. This picture shows that animals' normal environments may be exactly deciphered from their coloration.

Sphinx moth (Philampelus pandorus) on a birch trunk. Photographed from life by Dr. R. W. Shufeldt.

Suggestions for the Workshop

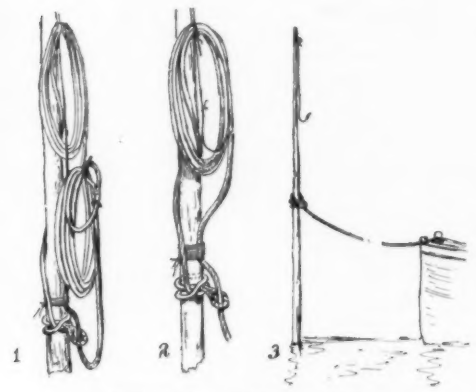
Ingenious Expedients of Resourceful Mechanics

Hints for the Boatman

By Albert F. Bishop

THE following suggestions have proved very useful to the writer and hence they are passed along to the handy men who read this department:

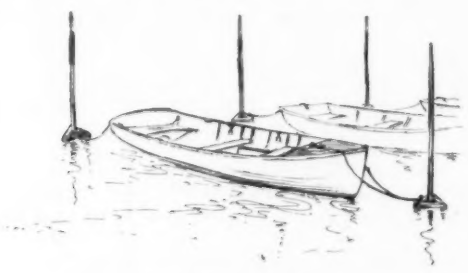
Rockers for a Launch.—A launch with quite a flat bottom and deep skag, when rolled down on its side, can be handled quite easily by one person by placing rockers under the hull. It will be noted in the illustration that the rockers *A* differ from those at *B*, which are in two parts. The two parts are held in place on



Method of mooring a launch.

the boat by one long bolt which passes through them and the skag. The forward rocker *A* simply fits up against the bottom and is held in place by a small rope or cord which passes up over the deck and is fastened to opposite ends of the rocker. When the bottom has been cleaned and painted and the boat is leveled up, skids *C* are attached to the rockers. Now the boat can be safely handled in any direction by the use of rolls or sliding ways. One of the skids is shown at *C*.

How to Fasten a Launch to a Mooring Stake.—If the launch has a sampson post on the bow, the mooring



Safe mooring for small boats.

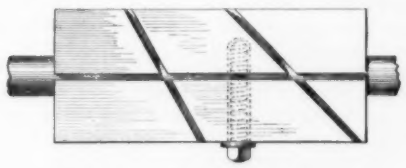
rope or cable should have an eye splice at each end. The cable is fastened to the stake by two half hitches, as in Fig. 1. The entire length of the cable is then passed through the eye splice close to the stake. About one-third of this cable is coiled up and tied with a small cord at the top of the stake. The rope in this coil is used in heavy weather. By simply cutting the seizing, which is near the half hitches, the upper coil can be paid out. The lower coil, which is hung on a small wire hook, is used in ordinary weather. When coming alongside the stake, the coil is lifted off and the eye splice is placed on the sampson post. There should be a small bow line placed around the upper part of the sampson post, with a couple of half hitches, and then brought back to the cleat and made fast. This will prevent the eye splice from slipping off except when desired. Fig. 2 shows the stake with the lower coil of the mooring rope in use. Fig. 3 shows the entire length paid out. The half hitch of the cable which is fastened to the stake can be seized to the stake, if the stake is a limber one and liable to bend so much as to present the danger of pulling the half hitch off over the top. However, this is very unlikely to happen. Hanging up the cable and keeping it out of the salt water prolongs its life.

Mooring Small Skiffs or Rowboats.—When the water space is limited and it is desired to moor several small boats, use a small triangle which will float readily and it will work up and down a stake with the tide. This permits of using a very short painter. The illustration shows the device quite clearly. The triangle is best made out of pine wood, 2 inches by 3 inches.

Sawing Tubing at an Angle

By H. D. Chapman

THE writer recently had a large number of copper tubes to cut at angles of 45 and 60 degrees. It was hard to cut these tubes with a hack saw or to place them in the milling machine and set to the required angle. The line cut shows a clamping jig that was rigged up for the purpose and the tubing was cut with a hack saw in less time than would have been required in the machine. The tubing was 5/8 inch in diameter; a square piece of machine steel was shaped up as shown.



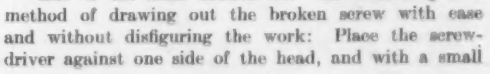
Sawing tubing at an angle.

A hole was bored through the block to suit the tubing. The block was then put in the milling machine and set at an angle of 45 degrees and a slot was cut at that angle. The jig was then set at a 60-degree angle and a second slot was cut. A slot was then cut parallel with the bore so that the jig could be closed upon the tubing. A 3/8-inch hole was drilled and tapped for a set-screw so that when the job was placed in the jig the screw would clamp the tubing.

A Three-line Drafting Pencil

By George W. Colles, M.E.

THE SCIENTIFIC AMERICAN some time since described a two-line drafting pencil for lettering, which was good as far as it went, but how shall we make a three-line pencil? Three-line pencils are usually needed for large-size lettering, where capital and small letters are used. Adding another pencil lead to the holder shown in the aforesaid article will not do well for two reasons: First, it is difficult to make the holder hold three leads tightly, and secondly, it is impracticable to make all three leads mark at once. Several years since, having much lettering to do of a uniform size, and becoming tired of spacing off and drawing three lines separately for each line of lettering, the writer solved the problem as follows: A stick of solder, such as electricians use, about the size of No. 10 or 12 wire, was procured. The end was flattened with a hammer. Three parallel lines were marked at the proper distance on the flattened end, and three points were filed in the corresponding positions, as shown in the sketch. The solder made very light lines on the paper, and wore very little. When the points got dull, it was merely necessary to file them off. The effectiveness of this arrangement was due to the fact that the solder bends easily, so as to make all three points touch the paper.



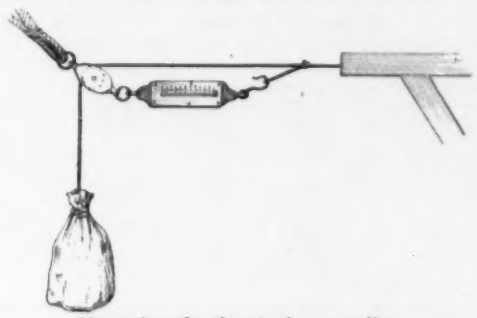
A three-line pencil made of solder.

Usually not more than two or three sizes of lettering are used, and by preparing as many sizes of pencil, the proper size can be drawn at any moment without any spacing or measuring.

How to Determine the Thrust of a Propeller

By J. V. Romig

A CONVINCING way of determining the thrust of a propeller, whether of the type used for aeroplanes or of the type used on boats, is to employ a simple rigging, such as that shown in the accompanying illustration. At the right of the drawing may be seen a bracket upon which the engine that drives the propeller is mounted. This bracket may be taken to represent the boat if a marine propeller is being tested. A line runs from the bracket or the boat over a single pulley fastened to some fixed support, and to the line is attached a weight. The latter may consist of a bag filled with stones or scrap iron and weighing 25 pounds. An ordinary 25-pound spring scale is then attached to



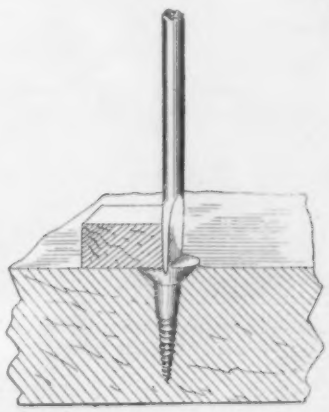
Measuring the thrust of a propeller.

the pulley at one end, and to the line at the other with a little slack. When the propeller is started, it must first lift the weight attached to the line before it commences to pull on the spring scale. The front of the propeller will equal the amount registered on the scale plus the weight of the bag. If the propeller draws the spring scale out to its full extent, a second 25-pound bag may be added to the line. Thus, with a single 25-pound scale it will be possible to measure thrusts running above 50, 75, or even 100 pounds. To be sure, a certain allowance must be made for friction on the bearings of the pulley, but this will be negligible, particularly when the thrust is heavy.

How to Extract a Damaged Screw

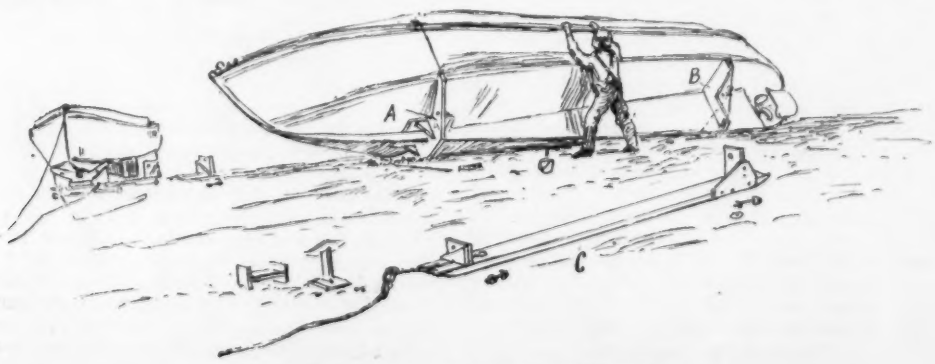
By William Grötzinger

ONE is often required to remove a screw with one side of the head broken off. The following is a method of drawing out the broken screw with ease and without disfiguring the work: Place the screwdriver against one side of the head, and with a small



Extracting a screw with broken head.

block, press firmly against the screwdriver, at the same time turning the screwdriver and the block. The screw will come out almost as easily as if the head were intact.



Rockers for handling a flat-bottomed launch.

Inventions New and Interesting

Simple Patent Law; Patent Office News; What Inventors Are Doing

Novel Automobile Accessories

Electrically Heated Gloves for Drivers

ONE of the accompanying illustrations shows the use of electrically heated gloves of special interest to autoists, aviators, and other drivers of vehicles. There should be a great field for this glove, aside from its use with automobiles, as it can be readily attached

Electric heat regulator, and glove with contact points.

to aeroplanes, motor cycles, motor boats, in fact, all vehicles that have to be controlled by the hands. Suitable contact plates can also be easily fitted to the reins for driving horses.

The inventor contends that experience has proven that the only practical place to do this heating is on the inside of the glove itself, and not by heating the

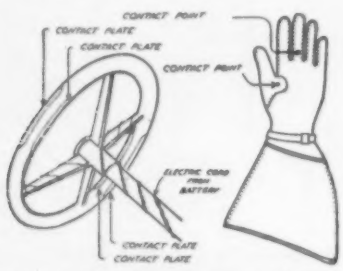


Diagram showing all contact points and plates of glove and wheel.

wheel, as some inventors have tried to do. The electricity is taken into the glove and there converted into heat; and by reason of these heating coils being fully protected from actual contact with the cold air, it can be readily seen that this method is far superior to heating a wheel that is exposed, and which at best only heats the inside of the hand.

Electrically heated gloves gripping contact plates of steering wheel.

This invention is the result of a persistent effort in overcoming the great objection to winter motoring. It has been comparatively easy to keep the feet and the body warm, but previously it was impossible to do this for the hands. One of the best features is that there are no wires directly connected to the gloves, thus leaving the hands perfectly free at all times to manipulate the levers.

The current passes from the bottom plate into the contact point on the finger, through the heating coils, and out at the contact point on the inside of the thumb to the top plate. This top plate is connected to the metal of the wheel by means of a small pin or screw, and thus completing the circuit by what is commonly known as a "ground." The connections are very simple, and the wiring consists of a wire from the positive post of the battery to one post of the rheostat or regulator on the dash.

When desired, this regulator can be attached to the steering post or on top of the wheel, within easy reach of the driver. A double lamp cord is connected to the other post of the regulator, and, after being wound around the post, is separated and one wire run to each of the bottom plates.

It will be seen that the regulator allows the driver to cut down the heat to a point that is just comfortably warm, or in case of zero weather, he can turn the current on fully and heat to a degree that will defy the coldest weather. This regulation is very gradual, and easily controlled by a small lever.

The consumption of current for ordinary winter weather is less than is consumed by a six-candle-power side or tail lamp. This means that the gloves are very efficient, operating continuously for about forty-five hours on one charge from the ordinary storage battery.

At the present time with electric storers and ignition apparatus, a large majority of cars are so completely equipped with batteries and generators also for lighting purposes that no further expense is necessary in order to use this glove.

The wire used in this glove is not only very pliable, but it is placed therein in a way so as to avoid all short bends; which arrangement makes the article very durable, and also sufficiently flexible. In case it does break, the inner glove can be easily replaced in a few seconds at a very low cost, in fact, when compared to the expense of replacing punctured or blown-out tires, or even a spark plug, it is an item hardly worthy of mention, especially when the comfort derived from the glove is so great in very cold weather.

Kerosene Vaporizer for Motors

Many efforts have been made to produce carbureters or other devices that would make it possible to run automobile engines on kerosene, which costs but little more than half as much as gasoline, is much less volatile and dangerous and which can be obtained in quantity at any country grocery or general store. No very satisfactory process for the purpose had been developed up to the present year, but during the summer of 1911 a device called a hydrocarbon gas producer or oil converter was put on the market by a new eastern company.

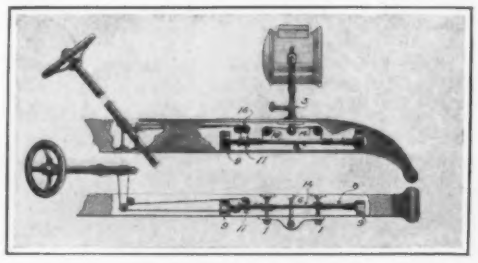
The device operates on the principle of the suction gas producer and is the result of six years of study and experiment. The manufacturers claim that it will run any gasoline engine of standard make on kerosene with no decrease in power and with no increase in fuel consumption; supply a perfect mixture to the engine under all conditions of speed and load, use every atom of fuel and prevent smoky exhaust due to imperfect combustion. No alteration in the engine is required to attach the converter, which is affixed in the same way as the muffler, but as close to the exhaust ports as the construction of the engine will permit.

In operation, the engine is started on gasoline in the ordinary way, and after running for three or four minutes to allow the exhaust gas to heat up the coils inside the converter, the gasoline is shut off automatically by a thermostat and the kerosene is turned on. The latter is taken into the converter in the form of a vapor through a special mixing valve and is then passed through the coils, where it is maintained at an even temperature for a given length of time. It leaves the converter as a gas and is piped directly to the auxiliary air intake of the regular carbureter on the engine.

It has been found by a series of conclusive tests with two-cycle and four-cycle gasoline engines, that with the gas producer attached the consumption of fuel is about 15 per cent less, and, as kerosene sells for five cents a gallon in quantity and from eight to twelve cents by the gallon in different parts of the country, there is a saving of more than one-half in the fuel bill. The converter operates equally well with denatured alcohol. It is cylindrical and about 5 inches in diameter, the length being about double this, but varying according to the size of the engine. It has no moving part and, once attached, needs no further attention.

Headlight Turning Device

When an automobile turns a sharp corner at night, the headlights, being immovable on the frame, do not throw their light around the turn, and on a dark night there is danger of collision or running into a ditch. To remedy this fault, a number of devices for automatically turning the lamps with the front wheels have been patented and several are on the market. Two of the accompanying illustrations show a recently patented device of this kind. All of the operating mechanism is concealed within the channel of one of the side frames of the car except a cross rod that links one lamp bracket to the other. The brackets (3) are mounted rotatably in sockets formed in lugs secured to the frame by bolts (1). One of the brackets has a horizontal arm (6) which passes through a slot cut in the frame and has a steel cable (14) passed around it. This cable also passes over idle pulleys (10) on the bolts (1) and thence down to a longitudinal rod (8) that rotates in bearings (9) in the frame member. The ends of the cable are given several turns around this rod in opposite directions and then secured to it. Around a drum (11) near the rear end of the rod under the hood, a second cable is given a double turn and passes around pulleys (16) and thence around a rotating part of the steering column, to which its ends are fastened. Provision is made to take up lost motion in the steering

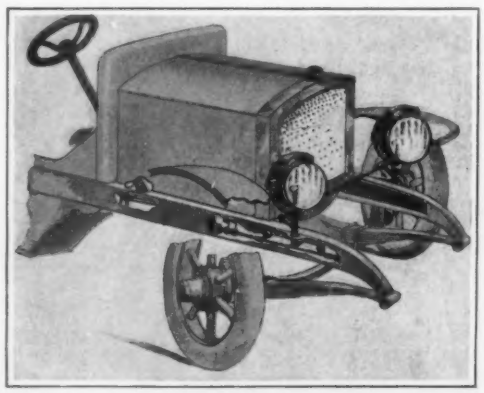


Operating mechanism for automatically turning automobile headlights.

gear and a coil spring at the forward end of the rod tends to keep the lamps directed straight ahead except when turned forcibly. When the steering wheel is turned decisively in either direction, both lamps are turned in the same direction as the front wheels and to the same angle.

Acetylene Generator Tank

So popular has become the gas tank for lighting that it is recognized as standard equipment almost as much as tire irons for securing spare tires to the side of the car. This drift of preference by users has led to the production of a generator that is made in the



The headlight turning mechanism installed on an automobile.

form of the compressed gas tank, and would be mistaken for one by the casual observer. Instead of being made as an improvement over the old vertical form of rolled copper generators by one of the gas lamp manufacturers, as might be expected, it is the product of a specialty or accessory house.

Briefly, this new type of generator, which is cylindrical and designed to be carried horizontally on the running board, is made of heavy steel welded together throughout, so that no rivets or soldering are required. It is 6 inches in diameter by 22 inches long, and is composed of two compartments separated by a vertical diaphragm. The smaller compartment is for water

and has a capacity of two quarts. It is filled through a hole at the top while the tank lies in normal position. The other chamber is for calcium carbide, which is introduced through a large hole in the end after the tank has been set up on the opposite end. A full charge is 6½ pounds of half-inch carbide. The screw plug in the end of the tank has attached to it a small metal cup, which is filled with about two teaspoonfuls of water before it is screwed back in place.

When the tank is laid down, the water in the cup spills into the carbide and instantly generates gas that fills the remaining space in the carbide chamber. As the pressure increases, some of the gas is forced through a metal tube at the top of the chamber which passes through the diaphragm and down nearly to the bottom of the water reservoir. Rising, the gas fills the space above the water, until pressure is equalized. The tank is now ready for use.

As soon as the lamps begin to draw off the gas from the carbide chamber through the escape pipe above the screw plug, pressure is reduced in that chamber and the greater pressure in the water compartment forces a small quantity of water through the tube into the carbide chamber. A distributor causes it to drip in several places so that generation will be uniform. The flow of water ceases automatically as soon as the pressure in the two sides is equalized again. This action continues until all the water or all the carbide is exhausted.

Pressure in the tank is maintained at about 15 pounds by an automatic regulating valve placed in the water end of the tank and communicating with the gas above the water. This allows a small quantity of the gas to escape when the pressure exceeds the predetermined maximum, thus instantly checking the flow of water to the carbide and stopping excessive generation. A pressure gage attached to the tank indicates the state of the generator at all times. Before it goes to the lamps the gas is dried and purified by passing through a tube packed with filtering material, through which it is forced under a pressure of from five to fifteen pounds, thereby causing it to produce a steady white flame.

Trade-mark Development During the Last Seven Years

THE United States trade-mark registration law went into effect April 1st, 1905. During the seven years it has been in force 62,500 applications for registration have been filed in the United States Patent Office; during the same number of years immediately preceding April 1st, 1905, while the trade-mark act of 1881 was in force, only 17,250 applications were filed. Under the present law, therefore, almost three and two thirds times as many applications have been presented in seven years as there were under the former law, during an equal number of years. This large increase in applications made is due in part to the reduction of the government fee from $25 to $10 under the present act; to the fact that trade-marks used in interstate commerce are now registrable, whereas they were not registrable under the former act if used only in interstate commerce; to the provision in the law permitting the recovery of three times the actual damages in suits for the infringement of registered marks; and to the greater liberality under this law, especially in view of the ten-year proviso. The increase is, however, largely due to the growing interest in all trade-mark matters.

A well-known captain of industry is reported recently to have said, "I would rather have a celebrated trade-mark than a million dollar plant." A manufacturer of jewelry and gold and silver ware, in a suit which is now pending to prevent the infringement of one of its best known marks, testified that this particular mark was worth $2,000,000 in money. The president of another well-known corporation in a speech at a celebration of its success made the statement that each letter of one of its word marks was worth $1,000,000. The famous "Chartreuse" mark has within the last six years been the subject of thirty suits in various countries. The value of the trade-marks of the American Tobacco Company as shown by the dissolution proceedings was estimated at $45,000,000; the entire assets of this trust, $227,000,000. That its marks are so valuable is not surprising for it had been the policy in the formation of that organization never to take in a competitor unless he had a valuable mark to identify his goods.

During the first three or four years the present law was in effect, there was some lack of uniformity in deciding doubtful cases. This is not surprising. The principles of trade-mark law are comparatively new. The first case involving a trade-mark was heard in the United States Supreme Court in 1870, and the first trade-mark case in any court of the United States was tried in 1837. Many of the recent decisions of appellate tribunals in such cases have been rendered by divided courts. Decisions of the Commissioner of Patents and the Court of Appeals of the District of Columbia, which is the appellate tribunal from the Commissioner of Patents, have, however, within the last two or three years settled many of the vexatious questions which arise in applications for registration of trade-marks in the United States Patent Office. It would indeed be surprising if the United States Patent Office was not subjected to some criticism for its treatment of applications for registration of trade-marks. A prominent English trade-mark lawyer at a dinner in London attended by the leading men in the profession, said of the practice in the British Patent Office in treating applications for registration of trade-marks that "it was inconceivably and absurdly inconsistent." Another speaker said the condition in respect to securing the registration of trade-marks was "beastly."

What constitutes a similarity of marks within the meaning of these words as used in the Trade-Mark Act was considered by the Court of Appeals of the District of Columbia in the case of Wayne Oounty Preserving Company v. The Burt Olney Canning Company, and again by that tribunal in the "Milkmaid" case. The general principles which should govern in determining whether a mark is so similar to a registered or known mark as to cause confusion are presented in these cases.

Another question of equal importance as the question of similarity of marks is the question of what goods are of the same descriptive properties. Fairly satisfactory rules have been laid down to determine this point in the cases of Baker v. Harrison, the Phoenix Paint and Varnish Company case and the case of Muralo v. National Lead Company.

The views of the Patent Office and of the Court of Appeals of the District of Columbia upon the question of what constitutes a descriptive mark, which is not registrable under the Trade-Mark Act, are given in the "Nextobeer" case and the Anti-Cori-Zine Chemical Company case. The decision of the Supreme Court of the United States in the recent case of Standard Paint Company v. Trinidad Asphalt Manufacturing Company is also helpful in determining whether a mark is descriptive and therefore invalid as a technical mark. A very important question was settled in the Johnson v. Brandau decision of the Court of Appeals of the District of Columbia. The right to include as a feature of the registered mark a subordinate or unimportant feature was denied. The court said that registration gave a *prima facie* right to the mark as it appears on the drawing and that a word which the public was entitled to use should have been disclaimed or removed from the drawing.

What constitutes a distinctive display of a name was for some time a most annoying question. The ruling of the Court of Appeals in the case of Old Lexington Club made it impossible for the Patent Office to register perfectly valid technical trade-marks, such as "Champion" and "Acme," if the applications were made by the Champion Company and Acme Company, respectively, if these words were not distinctively displayed. This ruling, which prevented the registration of several hundred marks, for which application had been filed, was overcome by the amendment to the statute which went into effect February 18th, 1911, and which provided that a mark shall not be refused registration because it is the name of the applicant if it is otherwise registrable. Not until the decision in the case *in re* Artesian Manufacturing Company was the Court of Appeals called upon to decide just what constitutes a distinctive display of a name. The court in that case laid down a rule, very clearly enunciated by the Commissioner of Patents in a former case, so that now all interested have some basis for determining this question.

The correct meaning of the ten-year proviso, which is next to the last proviso of Section 5 of the Trade-Mark Act, is still doubtful. The Court of Appeals of the District of Columbia in the Cahn, Belt case said that public insignia marks were not registrable even if presented under that proviso. The Circuit Court of the United States for the second circuit in the case of American Lead Pencil Company v. Gottlieb rendered a decision showing the value of registration under the ten-year proviso. The court said that registration under that proviso of a descriptive mark constituted a *prima facie* showing that the mark had acquired a secondary meaning. The recent decisions in the case of Davids v. Davids, two decisions having been rendered by the Circuit Court and two by the Circuit Court of Appeals of the second circuit, leave the question in a very perplexing condition.

The recognition of the great value of a trade-mark has within the last few years led not only traders but cities and states to adopt a mark, which if not strictly a trade-mark, indicates that the goods bearing it came from a particular locality, or were made by certain people. Some six years ago five hundred Irish manufacturers adopted a mark to indicate goods manufactured in Ireland. This association has been very successful; a great number of new members have joined and many fraudulent users of the mark have been prosecuted. The city of San Francisco recently adopted a representation of the sun setting in the sea with the name of the city underneath as its mark. South Dakota has adopted a shield across the face of which is a reproduction of the State and the words "Made in South Dakota." Iowa has adopted two concentric circles with the words "Made in Iowa" in the outer circle, and the head of a hawk on a wheel inclosed in the inner circle.

Textile manufacturers formerly did not as a rule use trade-marks upon their goods, nor attach much importance to a mark if used. They have recently, however, seen that they were dependent upon the pleasure of jobbing houses if they had no identifying mark, and the use of trade-marks is becoming general.

The growing interest in trade-marks has caused many associations of particular lines of manufacture to be formed for the purpose of preventing confusion and infringement. A register of all marks used by members is established and a committee of experts or a referee board is appointed to determine if a mark, which a member proposes to use, is an infringement of an existing mark and to settle all controversies. This prevents the adoption in good faith of an infringement of an established mark. Disputes are in this way settled without delay and without expensive litigation. Organizations have within recent years been formed in Japan, Australia, France, Mexico and other countries for the purpose of disseminating information on the subject of trade-marks and of securing the better protection of trade-marks by legislation and other means. A strong association of this character was formed in the United States in 1879.

Another Selden Patent

UP to the final adjudication of the celebrated Selden patent in its relation to automobiles, few, if any, patents had created so much interest or been the basis of so much litigation in the automobile art as said patent. Now a patent has been granted on June 4th, 1912, No. 1,028,501, to Mr. Selden as a division of his former application for patent, filed May 8th, 1879, the original application for the division having been filed in the Patent Office September 7th, 1895. In the period covering nearly seventeen years, in which this application has been in the Patent Office, it has been the subject of numerous actions on the part of the Patent Office and the Commissioner of Patents held the application abandoned for lack of sufficient prosecution, within the statutory period of two years.

Subsequently on re-hearing, the Commissioner on May 24th, 1910, in concluding a somewhat voluminous decision held that no error was made in the former decision holding the application abandoned and affirmed such decision. Thereafter, the case was appealed to the United States Court of Appeals of the District of Columbia and the said Court, speaking by Associate Justice Robb, reversed the decision of the Commissioner and remanded the case, with directions to the Commissioner to reinstate the application and thereafter the application was allowed, and the patent issued.

In the decision, the Court said, "The facts being admitted, the question of abandonment became one of law and is not governed by the same rule applicable to cases where it is sought to review the exercise of discretion on the part of the Commissioner."

The patent issued on June 4th, 1912, recites the object of the invention to be more particularly to produce a driving and steering truck embodying the motor in itself and provided with suitable connections whereby the motor may be controlled and the steering mechanism may be manipulated from the body of the vehicle with the parts so arranged and operated in connection with the running gear that the full carrying capacity of the body of the vehicle can be utilized for the transport of persons or goods; with a further object to provide a driving and steering truck which can be readily attached to and detached from the body of any road vehicle.

Notes for Inventors

A Reinforced Fibrous Cord.—Harold B. Morris of Michigan City, Indiana, in a patent, No. 1,027,751, provides an improved cord for use in the manufacture of chairs or other articles. The cord is formed from shredded fibrous material and a binding agent is provided with longitudinal grooves in which is filled an ornamenting strengthening material which is flexible and is relatively more durable than the fibrous material.

A German Swimming Apparatus.—A boat-like float has end floats or buoys, a longitudinal keel and an intermediate saddle-like portion on which the user lies astride. The saddle is depressed so that the body of the swimmer will be submerged, his head will be afloat and his arms and legs will be free for the ordinary swimming action. The invention is patented, No. 1,027,741, by Philip Lentz of Gross-Lichterfelde, near Berlin, Germany.

Preventing Frosting by Electricity.—Herman L. Darling of Delta, Colo., in a patent, No. 1,027,403, presents a system of saving buds and blossoms from frost in which a vibratory motion electricity motor is connected to fruit trees and supplied with power so that the vibratory motion generated by the motor will be imparted to the tree.

A Combined Drinking Fountain and Faucet.—A fixture which is patented by Porter S. Hamrick of Wausau, Wis., No. 1,027,474, involves the application to the discharge spout of a faucet of the tube of a drinking fountain, the drinking nozzle being at the top of such tube and the latter being journaled in the faucet spout and so ported that it may be turned to one position to deflect the water to the drinking nozzle or to another position to shut off the passage of water to the drinking nozzle and permit it to be discharged freely from the discharge-spout of the faucet.

RECENTLY PATENTED INVENTIONS

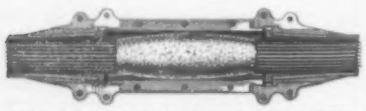
These columns are open to all patentees. The notices are inserted by special arrangement with the inventors. Terms on application to the Advertising Department of the SCIENTIFIC AMERICAN.

Pertaining to Aviation.

AIRSHIP PROPELLER.—R. H. MILTON, Greensboro, N. C. The purpose here is to provide a revolving propeller wherein buckets receive and hold the air during the power stroke and are opened to permit the free passage of the air during the idle portion of the stroke of the buckets so that the buckets will have a strong hold on the air while operating to drive the ship and will have a comparatively free return.

Electrical Devices.

PIPE AND CABLE COUPLING AND CASING THERETO.—G. W. MILLAR, 4036 Flad Ave., St. Louis, Mo. The purpose of this inventor is to provide novel features of construction for a coupling device that adapt it for effective service as a liquid and fluid tight coupling for an electric cable, the coupling in-



PIPE AND CABLE COUPLING AND CASING

closing the point between the ends of the cable and protecting the insulation thereon. In placing electric conducting wires underground, it is according to approved practice found essential that the wires be incased in lead pipes, for the protection of insulation that covers the wires forming the cable. The illustration gives a longitudinal sectional view of the improvement.

Of Interest to Farmers.

CORN PLANTER.—A. H. HALSTEAD, care of T. Allison, Columbus, Kan. This invention provides means in connection with the planter for permitting a charge of fertilizer to be deposited with the seed in each hill, or on the hill after the seed has been planted, or both in the hill and on the hill, as may be desired, or for permitting one or more kinds of seed to be deposited in each hill, with a charge of fertilizer on the hill.

ROOF CONSTRUCTION.—E. F. HODGSON, Parkinson and Manning Sts., Needham, Mass. The aim here is to provide an improved roof construction for portable houses whereby a free circulation of air is had with a view to keep the interior material dry, to prevent decay and interior sweating during cold weather, and to keep the roof cool during hot weather.

SINGLE-USE BOTTLE.—BERNARD ERDALE, No. 805 Greenwich Street, New York, N. Y. In this patent the invention relates to bottles of the kind which preclude more than a single use. More particularly stated, the inventor produces a bottle having a peculiar form of neck, so arranged that in order to open the

SINGLE-USE BOTTLE

bottle it is necessary to mutilate the neck in such manner that the bottle cannot be subsequently filled except under conditions which render detection an easy matter. The view shown herewith is partly in perspective and partly in section, presenting the upper portion of the receptacle as it appears when first filled.

PIANO KEY.—F. B. LONG, 413 W. 5th St., Los Angeles, Cal. This invention pertains to pianos, organs and like key-actuated musical instruments, and its aim is to provide a key, having means to render the key silent in action, and to prevent the key from being unduly influenced by climatic changes, at the same time rendering the key moth proof.

BUFFER FOR USE WITH WOOD PAVING.—G. T. VALLÉE, 5 Rue St. Ambroise, Paris, France. This invention remedies several disadvantages by taking up the thrusts which may be produced. The arrangement consists in a kind of buffer rigid in one direction and flexible in the other, so as to resist the rolling of vehicles and to yield to the thrusts of the wood paving, by placing it along the footpaths, across the roadway, against the tramway rails, in the middle of the track and across the same.

DOOR STRIP.—L. J. VALENTINE, Plainview, Tex. This invention refers generally to door strips and more particularly it comprehends a construction adapted to be carried by a door for engagement with the floor or sill and provides a construction wherein air and wind with any particles carried thereby may be kept out of a room.

MATCH BOX.—L. N. FORSYTH, New Iberia, La. The object of this inventor is to provide a box which will automatically present a lighted match when properly manipulated. Means provide for permitting a sleeve to expand slightly to allow matches of greater size to pass without injury or breakage and to insure the ignition of the smaller matches as well as those of the larger size.

Of General Interest.

COMPOSITION OF MATTER.—J. R. C. MARSH, 2111 Auburn Ave., Cincinnati, Ohio. This invention relates to a composition of matter for treating cast iron and steel in the ladle or crucible. An object is to treat metal in the crucible which will impart to the metal certain qualities that are ordinarily attained only by susbequent treatment. Mr. Marsh has also invented another composition of matter for treating cast iron and steel in the crucible or ladle or any other suitable retainer. His object is to increase the toughness of the metal, to add to its strength, to give it a finer grain, to remove objectionable substances, such as phosphorus, sulphur, etc., and make of iron or steel a better product than that which usually comes from the ladle. The same inventor has invented another composition of matter and by the process the iron is made harder and the grain finer. The metal has greater elastic limit and tensile strength. Both iron and steel are "hot hard," i. e., they retain their rigid form at high temperature, and in this resemble high speed steels and take a high polish.

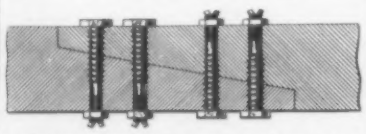
FOLDING VIOLIN BOW.—J. D. ADAMS, Phœnix, Ariz. The purpose here is the provision of means in connection with the bow for permitting the bow to be folded into small compass for convenience in carriage, and so arranged that when unfolded into playing position the hair may be properly tensioned and will be held in such condition.

FILTERING CAN AND THE LIKE.—J. F. HOCKER, Monroe, Ind. In general respects this can is similar to the can ordinarily used around houses or garages as a filler for automobiles, motor boats, motorcycles, flying machines, stationary gasoline engines or other devices to which it may be desired to discharge gasoline. It not only avoids the necessity of a separate filtering funnel, but by employing a vertical tubular filter or strainer, preferably of chamois, the water is permitted to settle at once to the bottom of the receiver while the gasoline can pass out into the can, the filtering operation being facilitated by the large filtering surface supplied by the tubular chamois filter.

HOISTING SLING.—T. J. SAMMON, care of A. H. Bull & Co., 8 Bridge St., Brooklyn, N. Y. This improvement refers to hoisting slings of the type which will engage and bind a load carried by the same, to prevent any of the bundles or other articles which the sling is designed to lift, from slipping out of place and dropping therefrom.

Hardware and Tools.

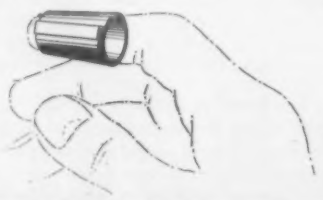
BOLT.—H. B. STEINHOUSE and C. L. STEINHOUSE, 419 Tenth St., Cairo, Ill. This improvement is for use in securing together two or more parts, one of which is wood, or such other material into which a lag screw may be threaded. The bolt when applied will not work loose or pull from the timber in which it is



BOLT FOR SECURING TWO OR MORE PARTS

placed, making it especially adaptable for securing freight or car grab irons, ladder rings, splices, etc. The engraving shows a longitudinal section through a splice between the two timbers, the timbers being secured together at the splice by a number of bolts of the type illustrated.

CUTTING DEVICE.—C. F. BILLAU, 1430 Second Ave., Cedar Rapids, Iowa. This invention relates generally to cutting devices and more particularly involves an attachment especially adapted for use on a person's finger in cutting flowers, fruit, twine, or similar articles. The device is of simple construction and



CUTTING DEVICE FOR FLOWERS, TWINE, ETC.

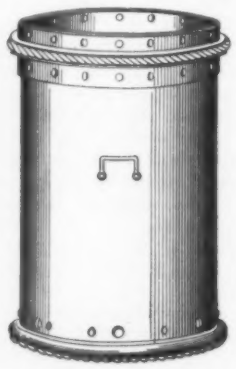
so arranged that it will not turn on the finger when in use, and it has a blade removably held on the device whereby it may be easily taken off for sharpening. The engraving pictures the attachment in position for use.

Heating and Lighting.

EVAPORATING APPARATUS.—J. A. POWER, care of Sanitary Water Still Co., Jamaica, L. I., N. Y. This apparatus is more especially designed for evaporating salt or other water to obtain a supply of fresh water, and is arranged to permit of conveniently rotating the steam heating device within the shell, to permit convenient access to the parts thereof, to make repairs quickly, and to prevent leakage.

Household Utilities.

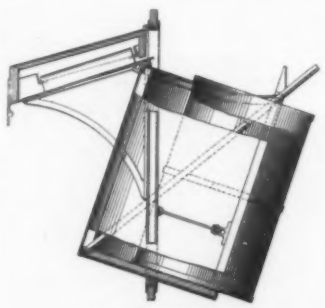
NOISELESS ASH CAN.—A. M. H. DEBRUYCKER, 173 Seventh Ave., Brooklyn, N. Y. The ash can shown in the accompanying perspective view is arranged to permit of moving the can over pavements, floors and the like,



NOISELESS ASH CAN

or bumping one can against the others without producing the undesirable noise now incident to handling metallic ash cans of the usual construction. For this purpose use is made of a ring of rope held between retaining members formed on bands or hoops attached to the body or cover of the can, the bands also forming reinforcing members for the body or cover.

GARBAGE CAN HOLDER.—A. D. GATCHEL, care of W. D. Gatchel & Sons, Louisville, Ky. In this case the invention involves a form of holder, the construction and arrangement being such that the frame in which the holder is suspended is designed to be carried



GARBAGE CAN HOLDER

by a fence or wall in an opening therein, the receptacle of the holder swinging from one side of the wall to the other, whereby the can is accessible from both sides of the fence or wall. Means are provided whereby a second cover will closely engage the top of the can, thereby doing away with odors arising from the material contained in the can in certain kinds of weather. The illustration inserted herewith shows the receptacle in one position.

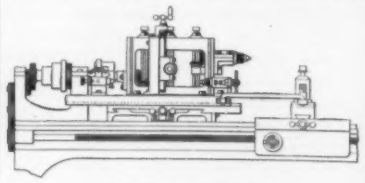
Machines and Mechanical Devices.

TRAP.— L. BARKER, Maricopa, Cal. This invention has for its principal object the provision of a structure which will operate in a satisfactory and efficient manner, the arrangement and number of the parts being such that it may be produced at a low cost. The trap is of very little height, and is adapted for use in small places where the ordinary trap could not be placed. It also has the advantage of being sanitary in the setting.

VALVE MECHANISM.—G. C. BECK, 2328 Boone Ave., Spokane, Wash. This mechanism is designed more particularly for internal combustion engines, the object being to provide a valve which is non-corrodible, water-cooled, self-lubricating and noiseless. By the arrangement of the parts, the valve is kept properly lubricated, and as it is also cooled on both sides, corrosion is effectually prevented.

MACHINE FOR MAKING BUILDING STONES.—W. A. TODD, Box 4, Point Pleasant, N. J. This machine produces building stones from blocks of concrete cement or other plastic materials, the building stones having different shaped front and rear faces to resemble natural stone building blocks, and when used in a building or house break the monotony of the facade of the structure.

LATHE ATTACHMENT.—R. HUGHES, 210 S. Third Ave., Mount Vernon, N. Y. This attachment is arranged to permit of doing milling or turning work, or both, at the same time, and to increase the swing of the lathe. Use is made of a frame removably attached to the lathe bed and provided with a milling spindle and with a gearing connecting the said spindle

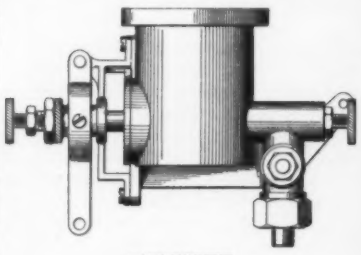


LATHE ATTACHMENT

with the lathe spindle and a milling table slidable on the frame and moving with the carriage of the lathe. Use is also made of a vertically adjustable lathe center mounted on the frame and driven from the lathe spindle, and a vertically adjustable auxiliary dead center mounted on a regular dead center of the lathe. The engraving shows a side elevation of lathe and milling and increased swing attachment mounted thereon.

Prime Movers and Their Accessories.

CARBURETER.—H. HEZINGER and C. HEZINGER, 1011 Lexington Ave., New York, N. Y. This invention provides a carbureter adjustable to vary the ratio or proportion of air and gasoline admitted to the carbureting chamber; provides a carbureter wherein the end of a float valve is dispensed with so that the



CARBURETER

throttle mechanism governs the admission of air to the chamber proportioned to gasoline admitted; provides a pin valve to control supply of gasoline to the carbureting chamber; provides a manually operative cut-off valve for gasoline; and provides a means wherein is prevented accumulation or surplus of gasoline in the carbureting chamber. The illustration shows a side elevation of the carbureter.

Pertaining to Recreation.

GAME APPARATUS.—J. D. HIRSCH, 103 W. Congress St., Savannah, Ga. The intention in this case is to provide a game wherein the element of chance will be largely involved and in which will be provided means whereby the player may indicate a number or series of numbers which he selects as probably occurring upon the series of numbers of a particular ticket.

Designs.

DESIGN FOR A LAMP SHADE.—J. FRIEDBERG, care of Wentraub Brass Mfg. Co., 27-31 Bleecker St., New York, N. Y. In this ornamental design for a lamp shade the upper portion is divided into nine parts that run from a center at the top and curve in concave lines to the base, from which depends a hanging portion whose edges are cut into segments of circle. Mr. Friedberg has designed another lamp shade of an ornamental square pattern. It is divided into four sides that slant from a small square top to the base, from which is pendant a border whose edges have a long bow line design.

NOTE.—Copies of any of these patents will be furnished by the SCIENTIFIC AMERICAN for ten cents each. Please state the name of the patentee, title of the invention, and date of this paper.

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PATENT No. 995,274. Serial No. 574,658 Safety Razor. A new and valuable idea. For full information concerning this patent address Henry J. Miller, 3451 Constance St., New Orleans, La.

SALE OF BRICK KILN PATENT.

UNITED STATES PATENT for "Downdraft Continuous Brick Kilns," numbered 719,974, issued to Alfred Yates, February 3, 1903, now owned by the Eastern Terra Cotta Brick and Tile Company, will be sold at Public Auction to the highest bidder at No. 70 State St., Room 63, Boston, Mass., on July 10, 1912, at 3 P. M., in pursuance to a decree of the Superior Court of Massachusetts for the County of Suffolk, by Daniel A. Rollins, Special Master. Terms, one-third of purchase price at time of sale, remainder upon delivery of papers. For particulars apply to Daniel A Rollins, Special Master, 28 School Street, Boston, Mass.

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MISCELLANEOUS

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NEW BOOKS, ETC.

WAVES AND RIPPLES IN WATER, AIR, AND ETHER. Being a Course of Christmas Lectures delivered at the Royal Institution of Great Britain. By J. A. Fleming. With illustrations. London: Society for Promoting Christian Knowledge, 1912. 12mo.; 299 pp.

This is a collection of the Christmas lectures delivered at the Royal Institution of Great Britain by Prof. Fleming. By a time-honored custom the lectures are invariably addressed to a juvenile audience; that is, juvenile in spirit rather than in age. Hence, the duties imposed upon the lecturer are to treat his subject so simply that the young mind will grasp the explanation. No man is more ably fitted for such a task than Prof. Fleming. Not only is he one of the foremost leading authorities on the wireless transmission of energy, but a lecturer of skill and experience. It is rarely indeed that we find so difficult a subject so well and so simply discussed. The character of the book is best shown, perhaps, by the following table of contents: Chapter I, Water Waves and Water Ripples; Chapter II, Waves and Ripples made by Ships; Chapter III, Waves and Ripples in the Air; Chapter IV, Sound and Music; Chapter V, Electric Oscillations and Electric Waves; Chapter VI, Waves and Ripples in the Ether.

THE OFFICIAL AMERICAN TEXTILE DIRECTORY. Containing Reports of All the Textile Manufacturing Establishments in the United States, Canada, and Mexico. Together with the YARN TRADE INDEX and Lists of Concerns in Lines of Business Selling to or Buying from Textile Mills. Boston: Lord & Nagle Company, 1912. 690 pp. Price, $3. Travelers' edition, price, $2.

The volume before us, which was compiled by the *Textile World Record*, is one of the best directories of this or other lines of manufacturers which we have ever seen. The contents, which have been revised by personal canvass, are readily referred to by one of the three indexes; the first, Buyers' Index for Machinery and Mill Supplies; the second, an Alphabetical Index of All the Mills and Manufacturers in the United States and Canada, arranged alphabetically without regard to location; and third, the Number and Kind of Mills in each State. The first part, which occupies 423 pages, gives a complete list of all of the Textile Manufacturers in the United States, Canada, and Mexico. The second part is a Yarn Trade Index and deals with cotton knitting yarns, cotton weaving yarns, woolen yarn, worsted yarns, silk yarns and thread, linen and jute yarns, yarn dealers, commission merchants and agents. The third part is devoted to concerns engaged in bleaching, dyeing, printing, and finishing textiles. The fourth part is devoted to raw materials, such as wastes, shoddy, and extracts, etc. The fifth part is devoted to a list of manufacturers' selling agents, dry goods commission houses and converters in the principal cities in the United States. The sixth part gives the mills classified according to the goods which are made. The entries are very full and give precisely the information which should be required by anyone who is interested in the manufacture or selling of textiles. The book is a most excellent example of the trade directory.

CHEMICAL PHENOMENA IN LIFE. By Frederick Czapek. London and New York: Harper & Brothers, 1911. 152 pp.

It is rarely indeed that a book on a new phase of science is written in popular form by one of the men who have contributed most toward what may be called the creation of that phase of science. Prof. Czapek's book happens to be one of that rare kind. The whole subject of biological chemistry is of such recent growth that many chemists are not fully aware of the remarkable steps that have been made within recent years. Since it relates almost entirely to the lower forms of life, Czapek's book may be regarded as a popular presentation of the chemistry of living colloids. It tells us much that is interesting about protoplasmic membranes, the ultra-microscopy of colloids, the velocity of re-actions, catalysis, general laws of immunity, and the like. Once and for all Prof. Czapek disposes of the old idea of a "vital force," and assures us that the physical forces with which we are familiar can be used to explain nearly everything that we know about living protoplasms, with the exception of the psychological phenomena.

WAVES OF THE SEA AND OTHER WATER WAVES. By Vaughan Cornish. Chicago: The Open Court Publishing Company. 8vo.; 374 pp.; with 50 photographs taken by the author.

Water in motion is always an inspiriting theme. Although the author has avowedly written to inform the mind rather than to stir the imagination, yet the lure of tumbling water permeates his whole work. Dr. Cornish's observations cover a period of fifteen years and include water waves in all parts of the world studied under the most varying conditions. The observations of seamen and others are also included and are made the subject of critical comment. He has measured waves and timed the arrival of breakers, reducing the results to the form of rough equations. The action of sea waves on shingle, sand, and mud, and the effects of the undertow, receive attention, as do also tidal bores, standing waves, roll waves, and the tracks of ships. The numerous illustrations are good; the frontispiece is particularly noticeable as showing the singular effect of waves meeting and crossing in very shallow water.

Co-operative Fire Protection for Small Communities

A Novel Experiment Conducted at Fort Smith, Arkansas

"I wanted to protect my business against fire loss in a manner that would enable me to rest easily at night, when the clanging alarms of the Fire Apparatus passed my doors, going toward that portion of the city in which my business was located. Investigation led me to believe the automatic sprinkler was the best method, as it furnishes perfect protection so cheaply that the saving in insurance premiums alone pays the entire cost in a very short time."
JOHN WITHERSPOON, FORT SMITH, ARK.

THE idea back of this simple statement led to the establishment of the first system of automatic fire protection in which several different properties, owned by different people, were grouped under a mutual plan.

It was found that the fire hazard in the property in question was considerable. On the upper floors of the building was a large coffee roaster. The lower floors were devoted to a wholesale fruit and produce business, with a cold storage plant in the basement. This combination made the insurance rate high.

The underlying idea, however, was to get protection which mere insurance cannot furnish; that is, to assure continuance in business without interruption, rather than a mere restitution of property loss through the medium of an insurance policy.

The building was found not strong enough to support a tank of water. It was then proposed to throw a bridge across an alley to the next building, the owner of which had become interested, and to make the tank (somewhat larger) serve both buildings. Then it was desired to extend the protection to another building across the street. Next a grocery company, a block away, became interested. This would have necessitated a still larger tank, and the two original buildings were not strong enough to carry the weight of the bridge, the enlarged tank and the contained water.

Mr. Witherspoon now began to investigate the possibility of interesting a number of other firms. Finally about a dozen were formed into a corporation which eventually secured from the city a franchise to erect a large steel tank on a vacant lot, and to lay private water mains in the streets, carrying the water supplies from this tank to the various properties to be protected.

The circumstances under which all this was done are so unusual as to furnish decidedly interesting ideas, and suggest the adoption of similar methods by other communities. The arrangement is perfectly simple in theory, although there was a considerable amount of complexity involved in carrying out the scheme.

The cylindrical tank, mounted on a steel tower and formed with a hemispherical bottom, is 20 feet in diameter, and 39 feet deep; the capacity is 100,000 gallons, and the bottom is 115 feet above the street level. It has a natural gas heater, used in the winter to prevent freezing. The tank is filled by a pump driven by electricity drawing water from the city mains. Of course, after the first filling the requirements are simply to make up for evaporation and the small quantities of water used automatically in case of fire.

The main water line from this tank, 10 inches in diameter, was run across the middle of a city block into one of the main streets, and then distributed by piping diminishing to 8 inches and 6 inches, for the supply of the several sprinkler systems. There are twelve buildings thus linked together, having a total of 7,924 automatic sprinklers. These twelve buildings are located on seven different city blocks, the greatest distance between them being about three blocks. The properties include, in addition to the buildings previously mentioned, two wholesale hardware houses, two wholesale dry-goods houses, a harness factory, a hat factory, a large furniture company, a drug house, and a candy factory. With one exception all of these buildings are either five, six, or seven stories in height. The total estimated valuation of buildings and contents is $2,250,000.

One of the most interesting features of the equipment lies in the automatic electric alarms installed in each building, and run by means of trunk wires to a fire station located a short distance away. These alarms are designed to ring whenever a single sprinkler operates. In this way the location of the disturbance is shown on an annunciator board in the fire station, while at the same time an 8-inch gong gives a loud warning peal.

This connection with the fire department does not imply lack of confidence in the adequacy of the sprinkler equipment to put out any incipient fire which may make it operate, but is precautionary. It is also necessary that warning be given whenever a sprinkler operates, in order to insure turning off the water, once the danger is past. This alarm system therefore makes it possible to minimize water damage, for only so many sprinklers will operate as are subjected to the temperature at which they are designed to fuse (155 deg. Fahr.). A great majority of all fires under these conditions are taken care of by not more than three or four units. This, in itself, indicates that the water is discharged only at the point of attack of the fire; that the building is not flooded, as is so frequently the case in ordinary fire-fighting; and that such water as is used is thrown right on the heart of the fire.

One practical test of this system came last September, when escaping gas in the basement of a harness factory caused a fire. Almost before the occupants of the building knew that a fire existed the sprinklers had opened and completely extinguished it. The combined fire and water loss in this instance was so small that the proprietor did not make any claim upon the insurance company for damages.

The total annual savings in insurance premiums in the properties protected by this system amounts to about $19,000. This saving, applied for about two and a half years upon the cost of the installation ($46,000), provides completely for a sinking fund, while an additional half year of saving takes care of interest and depreciation and upkeep as well. This means that the saving, after three years, is clear gain—just so much money put annually into the pockets of Mr. Witherspoon and his associates—and this in addition to the absolute protection to their property afforded by the sprinkler equipment, and to the personal sense of security, with all which that implies.

The maintenance of the entire installation, from the elevated tank to the uttermost sprinkler head, is under the supervision of one man employed for that purpose, who thoroughly understands the operation of automatic sprinklers and the construction and use of all the valves, and other portions of the apparatus. He makes a daily inspection of the entire property and a weekly report, which goes to the owners and to the insurance interests. In this way the equipment will be kept continually in repair; and will be always ready for the service for which it was installed.

Publication of the Scientific Papers of Sir William Herschel

PROF. T. J. J. SEE informs us that while preparing the second volume of his researches on the "Evolution of the Stellar Systems" in the spring of 1909, he had occasion to make a study of the writings of Sir William Herschel in the "Philosophical Transactions" (1781-1818) and became so much impressed with the high importance of these forgotten works that communications were addressed to several English scientific journals, and to the Council of the Royal Astronomical Society, urging the republication of Herschel's collected work. It happened that Sir William Huggins was greatly interested in the developments. Shortly after receiving Prof. See's request to awaken an interest in the subject he reported (January 20th, 1910) the appointment of a joint committee under

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which the Royal Society and Royal Astronomical Society have published the scientific papers of Sir William Herschel (April, 1912).

What is the Montessori Method?

(Concluded from page 565.)

the Montessori schools the teacher is comparatively free and the material is handled by the children. The activities with the Montessori material are closely related to some of the activities more or less directly useful, and in a very short time the children become independent and are able to help themselves and one another. In the Kindergarten, on the other hand, every visitor must be impressed with the fact that in spite of the marvelous dexterity of the children in manipulating the regular material, they are absolutely helpless when it comes to dressing themselves.

It is hardly to be expected that any system of education can be built up by one person and adopted as complete in itself, although enthusiasts will naturally attempt to apply the Montessori methods as sufficient in themselves. Those working with these materials will soon be able to determine whether they are not too rigid and whether the self-checking feature does not interfere with the play of the child's imagination and with the opportunity for creative work on the part of the children. It is possible that material will be devised to embody all the good features of the Montessori idea and still be capable of being put together in more than one way.

Educators are seriously studying this method and there can be no doubt that both our Kindergartens and our primary grades will be greatly modified as a result of Dr. Montessori's work, and that the gap between these two stages of the child's education will be bridged thereby. As to the application of her methods in the higher grades, we shall have to await the results of the work Dr. Montessori is now carrying on.

It is surprising that a woman of such thorough training and one who uses the scientific method as a basis for all of her work should lapse into the antiquated notions about diet and nutrition exposed in parts of her book. Thus she speaks of "nerve feeding substances" years after even the U. S. courts had found out that there are no special brain or nerve foods. Again she refers to sugar as a food for "building plastic tissue," and she recommends garlic and rue because they "disinfect the intestines and the lungs."

The translation of the Montessori book* by Miss Anne E. George, which has just been published, is well worth thoughtful reading by all interested in the broader problems of education as well as by those engaged in the technical work of teaching. The chapter on discipline will be a revelation to many who hold traditional ideas on the meaning of education.

Animal Masquerades

(Concluded from page 566.)

as anything of its size in Nature. But nine marvelously-tinted butterflies may repose unnoticed among flowers, while a tenth, of less brilliant endowments, is acclaimed as a wonder of conspicuousness.

The brilliant plumage of the long-legged flamingo, as it feeds in tropical swamps in the early morning or at evening, instead of making it a center of attraction, merely merges into the hues of the sunrise or sunset and becomes, to aquatic enemies, a part of the scene. The blue jay, sitting upon a fir tree in winter, is of exactly the same hue as the blue shadows seen upon the snow, and seems one of them. The bird of Paradise is lost in the delicate tracery of the tropical forest in a similar way.

Mr. Thayer goes so far as to hold that an animal's environment may be exactly determined from its pattern and coloration.

*The Montessori Method of Scientific Pedagogy as applied to Child Education in "The Children's Houses," with additions and revisions by the author. By Maria Montessori. Translated from the Italian by Anne E. George, with an introduction by Prof. Henry W. Homes of Harvard University. With thirty-two illustrations from photographs. New York, 1912. Frederick A. Stokes Company.

DOCTORS OF CIVILIZATION

¶ The next mid-month number of the Scientific American, which will bear the date July 13, will be devoted in part to the sanitary engineer and his work.

¶ The modern sanitary engineer is the doctor of civilization. To him is entrusted the health of whole communities. The story of his activities is so new that some of its most interesting aspects have not been disclosed to the general public.

¶ No scientific discovery has proved of more practical value in the development of civilization than the fact that most diseases are caused by bacteria—that uncleanliness and microbes are synonymous terms; and no scientific discovery has proved more startling than the fact that the methods of transmitting microbes are innumerable. Flies, fleas, insects of all kinds, rats and other living animals have proven to be not simply uncomfortable pests, but the most dangerous enemies of mankind. They are the transmitters of bacteria—natural inoculators of disease. To fight them is one great problem of the sanitary engineer, a problem which will be simply discussed in the July mid-month number of the Scientific American under the title "Insects and Disease."

¶ Sewage and its disposal affects not simply the community at large, but the individual house owner as well. The present method of polluting streams and harbors with drainage will soon be obsolete. How that is slowly being accomplished will be revealed by Prof. Sedgwick of the Massachusetts Institute of Technology.

¶ There will be other articles on sanitation in the mid-month number of the Scientific American. Some of them will deal with sanitation, others with those timely scientific subjects which it is the mission of the Scientific American to describe in its own simple and accurate way.

¶ The number will be found on all newsstands. Price 15 cents.

Originally a painter of landscapes, birds, and animals, he has lived much in the open in various parts of the world and has studied the flora and fauna of both tropical and temperate zones. It was seventeen years ago that he first began to glimpse the facts which we have summarized above, and he has been adding to his knowledge ever since. A fine presentation of these facts is to be found in a recent volume which he has entitled "Concealing Coloration in the Animal Kingdom." Here he has marshaled his observations and his arguments and has given us some extraordinary pictures in support of his views and contentions. Many of these are in colors, and constitute what the author-artist believes to be the first collection of scientific paintings ever published of animals lighted exactly as they are in Nature.

Photographs reproduced herewith show a dummy ass and zebra suspended behind some brush, and several azaleas—pink, red, and white—upon which a considerable number of stuffed humming birds were arranged. When viewed through the brush the zebra, which is then on the left, is about invisible, owing to its white stripes merging with the sky and the black ones corresponding to the sticks. To the human eye the zebra was almost as completely blotted out as to the lens of the camera. The same was the case with the humming birds, out of a score of which only two or three could be distinguished even at close range (three or four feet). That no special arranging of the birds was necessary in order to render them invisible, was shown by the fact that the spectators were allowed to place them at random, and yet with practically the same results. As the humming bird is practically one of the most exposed of any bird, being in constant motion while gathering honey, it appears to be so well matched to the flowers which it frequents as to be very inconspicuous. When stuffed and laid upon them, therefore, it is invisible, for there is scarcely any position in which it can be placed that it will not match perfectly the background of flowers or green leaves.

In addition to the demonstrations above mentioned, Mr. Thayer gave an equally striking one with two dummy birds two or three inches above the ground. One of these was painted brown to match the earth and could be distinctly seen. The other, shaded gradually lighter from top to breast (which was white) was invisible upon the dried grass. although close to the unshaded bird.

So instructive were these demonstrations by Mr. Thayer that we hope he will be able to give more in the near future, and to show teachers and school children the true facts regarding the coloring and marking of birds and animals.

Formic and Lactic Acids

OF these two acids about a thousand tons are used in France every year, of a value of about $160 per ton.

The formic acid is used in the dyeing industry, serving chiefly as a mordant and for brightening the colors. Its reducing power is applied for bleaching. It is used in tanning and for removing the hair from skins, as well as for dyeing leather. The formates of chromium and aluminium are important products.

Formic acid, which gets its name from the fact that it was first observed in the red ant (*Formica*) could not become of commerical importance as long as its occurrence in nature was the sole source of supply. The acrid juice of nettles and a few other plants, the ant and a few other animals, and slight traces in the muscles of higher animals are the natural sources of this acid. About fifteen years ago the production of the acid by synthetic methods led to the development of its technical applications. According to the method of Berthelot, carbon dioxid gas is combined with caustic soda or potash. In the Goldschmidt process the gas is condensed to six or seven atmospheres and passed into caustic soda solution at a temperature of from 300 deg. Fahr. to 340 deg. Fahr. By this process the yield is almost 100 per cent of the theoretical requirement. The formate of sodium that is formed is decomposed by sulphuric acid in dilute solution. The manufacture of formic acid is confined to Germany, but it is hoped to develop the industry in France under the protection of a new differential tariff of about thirty to thirty-six dollars a ton, according to concentration.

Lactic acid, which was formerly produced only as a means for manufacturing certain compounds that were used medicinally, has come to be applied directly in the industries. It is used as a discharge in cotton printing, in tanning leather, and for removing hair from fur. The lactate of antimony is now preferred to tartar emetic as a mor ant in dyeing.

Lactic acid is manufactured by means of a double fermentation process. Beginning with a quantity of starch, or crushed grain, the material is first malted; this converts the starch into sugars. Then the lactic bacteria are introduced, together with chalk, or lime. As the acid is formed it combines with the lime, forming a lactate. This must be afterward decomposed with acid. One hundred and twenty pounds of starch or 150 pounds of grain yield about 100 pounds of lactic acid. This product is also protected by a tariff in France, since its manufacture there is more expensive than in Germany.

American Road Congress

ALL the efforts that have been made in the last decade to give the United States a system of public roads equal to the one possessed by France will come to a focus in Atlantic City from September 30th to October 5th, when the American Road Congress holds its first annual session.

The American Road Congress will mark the consolidation of the conventions of forty of the most important road organizations in the United States including the American Association for Highway Improvement and the American Automobile Association. President Taft is the honorary president of the Congress, which has for its active president, Director Page, and for its treasurer, Lee McClung, treasurer of the United States.

The National Association of Road Machinery and Material Manufacturers has voted to hold its exposition of materials and equipment in conjunction with the Congress. Among the members of the Manufacturers' Association are many of the largest manufacturing companies in the world. Every industry relating to the building and care of roads and bridges will be represented, and it will be possible for the road builders and road users to acquaint themselves fully with all the labor-saving devices, methods and formulæ that American ingenuity and inventive genius have brought out during the past century.

A remarkably ingenious exhibit will be made by the U. S. Office of Public Roads consisting of a complete set of miniature models illustrating every known type of roads and miniature working models of rollers, crushers and various equipment operated by tiny electric motors. The government's priceless collection of models showing the development of transportation from the primitive human burden bearer to the modern automobile and locomotive may also form a feature of the exposition. "Old Trails" exhibits recalling scenes along the famous old roads and trails such as "The Old Cumberland Road" and the "Santa Fé Trail" will add picturesqueness to the display.

One of the principal organizations composing the Congress will be the American Association for Highway Improvement composed of about 1,500 men who are leaders in their respective lines of activity throughout the United States. Thirty-five organizations for road improvement are identified with the association and twenty railroad companies are giving it their support.

The American Automobile Association will represent at the Congress the large and ever increasing number of road users, who, while adding to the difficult problem of road construction and maintenance because of motor traffic, are giving a new importance and uses to the roads and are contributing heavily to road improvement.

The United States is paying $1,000,000 a

Sensitive Laboratory Balance

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The Relation of Minerals to Digestion

IN the pancreatic juice of the cow and of the dog there are present various minerals, such as carbonates, chlorides, sulphates and phosphates of sodium, potassium, calcium and magnesium. Two French experimenters, Albert Frouin and Arthur Compton, have attempted to find out whether these salts are in any way concerned in the digestion of proteins by the pancreatic ferment trypsin.

The pancreatic juice was obtained by injecting secretin, which causes the gland to secrete abundantly. This juice by itself has no action upon coagulated white-of-egg; upon the addition of intestinal juice, it becomes active. A mixture of pancreatic and intestinal juices was placed in collodion bags and dialyzed against distilled water for from sixty-six to seventy-two hours, in order to wash out the mineral salts. At the end of this time the mixture is completely indifferent to the coagulated albumen. The addition of some salts to this solution again makes it active in digestion.

In one experiment the juice from the pancreas of a dog was mixed with one-fourth its volume of intestinal juice which had been previously centrifuged to remove all solid particles. The mixture was centrifuged and placed in a sterilized collodion sac; this was placed in distilled water for three days, the water being changed frequently, so that all the mineral matter was removed. A portion of the resulting liquid was placed in a test-tube with a cube of hard-boiled white of egg. After eight days there was no sign of any digestive action. But other portions of the same liquid, to which various salts had been added, showed evidence of digestion within twenty-four hours.

The authors point out, in their paper before the Paris Academy of Sciences, that if the dialysis is incomplete some salts will be retained and digestion will take place. Again, if the dialysis is prolonged beyond a certain point the failure to obtain digestion may be due to destruction of ferment, or to the diffusion of some of the ferment through the collodion. They obtained most definite results by dialyzing for 66 to 72 hours.

In employing salts to reactivate the dialyzed juices, they at first experimented with the salts normally present in the pancreatic juice. But later they used many other salts which also had the same effects. Some of the substances used were the bromides, iodides and fluorides of sodium and potassium; acetate, citrate and borate of sodium; chlorides and bromides of ammonia; chlorides of barium, strontium and manganese.

In other experiments the bases of sodium and barium were used. At certain concentrations these also served to reactivate the dialyzed juice. Although the active pancreatic juice is capable of digesting albumen in the presence of acids, the addition of free acids to dialyzed juices never served to reactivate the ferment.

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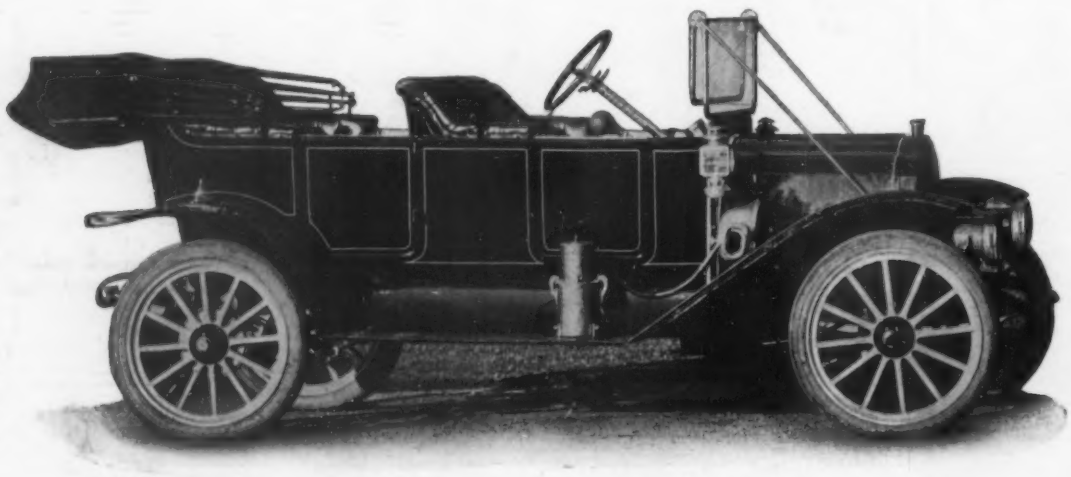

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